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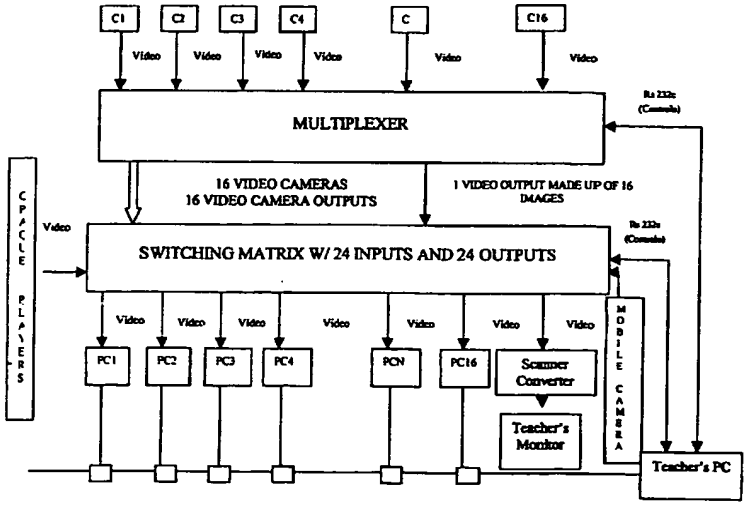

(57) Abstract: This invention is a interactive pedagogical system for all levels of the teaching/learning process comprising a group of means (video, audio, databases etc.) and a methodology which is developed to maximise the concentration of essential information transmitted to a learner. The system's methodology allows the materialization of the learning network concept, permitting an improved communication between teachers and learners through the use of online knowledge transfers. The system also does not permit the isolation of the learner, because through the different interactive resources (graphical information, films, animation, databases) it aims to immediately solve various difficulties directly from the learner's own workstation. The system, and technological means that constitute it, are under the control of a manager/teacher, and enable him to continously monitor and control the learner's progress more thouroughly, and at the same time providing an individualised bidirectional teacher/learner relationship.

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DESCRIPTION

"INTERACTIVE TEACHING/LEARNING SYSTEM"

Technical Field

The invention presented is an important tool in education at various levels of the learning process based on a group of resources and on a methodology that were developed to maximize the centralization of essential information transmitted to the learner.

The invention proposes an interactive pedagogical system, whose methodology allows network learning ideas to materialize. In this way communication between teachers and learners is noticeably facilitated through online knowledge transfer.

Although this system may naturally be applied to all areas of knowledge, it will be best employed when the subject being analyzed with different objectives and different directions is mainly characterized by a high usage of fixed or dynamic image towards a more efficient learning.

Background Art

The continuous improvement of human performance, development and learning has been the goal of many different pedagogical methods proposed over the years. These methods have brought about a wide variety of controversial issues concerning the best way to teach.

The concept of teaching can briefly be defined as the transfer of knowledge, information or useful or indispensable explanations of intellectual training of one individual or for a specific end.

The definition of real-time along with the necessary simultaneous use of different technologies (audio, video, data bases) realistically allows the visualization of what the learner performs, creating a comparative advantage by increasing the quality of different academic activities. The real interaction aims to diminish the lack of response or even the absence of the learner's doubts, revealing a total involvement and interaction between, learner, teacher and content area.

The traditional interaction in paper format displays a slow output in the course of the learning process, from which results a minimal or even lack of pedagogical interaction. That difficulty in avoiding the processes of isolation with the adoption of new formats is high, thanks to the constant occurrence of questions of repetition or strength that cause an even greater lack of pedagogical motivation.

The tele-learning model, in its basic forms (radio, TV, video), is characterized by its unidirectional interaction. This system produces poor results such as a lack of feedback from the learner and a large rate of absenteeism. In this system, the much recognized utility and advantages of interactivity are put aside.

Another main aspect that the traditional audio conference neglects is the importance of the graphical dimension, so crucial to learning nowadays in terms of cognitive interaction models.

There is today a subtle new revolution in the world in which the common factor derives is the existence of different information technologies as well as its availability. In fact, this revolution reproduces and creates two new concepts: the information society and global communication, promoting in that way the decline of standardization by the appearance of diversity.

Flexible learning is based on the paradigm of change, in which the concept of education is replaced with the concept of learning. The passive attitudes are replaced

with active and proactive behaviors. The individual's vision is replaced with the concept of team. Finally, the teacher becomes a tutor.

This development allows a careful globalization of education, in which the openness, interactivity, integration and flexibility appear as decisive factors.

The world, and the knowledge we possess of it, is changing. The professional's life cycle, in certain circumstances, appears to have a short time slot. This makes professional knowledge appear as being redundant and irrelevant implying an operationalization of training concepts throughout life towards an optimization of the way to deal with changes. Therefore, it is necessary to be continuously updated from the beginning of initial training.

Disclosure of Invention

New technologies have been developed to ease the transmission of information, through the use of computers, between those who possess the knowledge and those who wish to assimilate it.

Some examples are the Brazilian patent requests PI 9605686-0, from 21/11/1996, and PI9805327-2, from 09/12/1998, with American priority US 60/069142, from 09/12/1997, and the PI9707197-8, corresponding to the international request PCT/US97/27572.

The Brazilian patent request PI 9605686-0 suggests a multimedia system and audiovisual resources for learning. In this system, audiovisual equipment and resources are applied to the learning situation or demonstration. This patent aims to encourage the learner to present their ideas and to question that which is presented to him/her. This system combines a central made up of a modular and upgradeable system, based on the processing of all the reception signals, later amplification of several channels that make

up the central and have power sources mono-channel amplifiers and synthesized modulators. Besides this central, this system has video monitors and audio and video creation equipment, rooms with panels with special commands and television monitors that work together where learning is seen to take place, receiving audio and video from the central.

The Brazilian patent request PI9805327-2 is a computerized learning and lesson management system that does not need teachers to help improve the learner's capacity to learn using a remote computer. Multiple disks or CD-ROMs are used in this system to load the data of the program at the training location. The local computer communicates via network with the server and the software found in the CD-ROMs determines, from the server, the availability of upgrading. The system also contains a special mechanism found in the software that does not allow the local computer to have access to specific data without a given password from the remote computer. This feature prevents the learner to see any part of the program prior to being able to prove that they have met the necessary pre-requisites to access such information.

The Brazilian Patent request PI 9707197-8, which is equivalent to the international patent request PCT/US97/27572, proposes a remote learning system that uses television signals and a network. The main objective of this system is to solve the problem related to learning that takes place not within the same physical space. As a result, this system foresees that the learners are given a visual presentation, and when necessary, an audio presentation, including for example, images of the instructor to help ease the interaction between teacher and learner and vice-versa.

The remote learning system proposed by the international request PCT/US97/27572 consists of a remote communication system between a client (learner) and a server (teacher), being able to easily incorporate data provided to the client in

intervals of a television signal and transmit this signal. The client receives this signal in a video overlay card, which separates the given components of that signal in television standard signals. Consequently, on-line service information as well as remote user information using television signals are received by learners using personal multimedia computers. Furthermore, each computer can communicate with a main server using a network, just like a telephone or public radio network.

The interactive educational system presented here aims to solve several problems, which have not yet been solved, related to efficiency in the learning process, especially at the higher education level.

The proposed system of the present invention is characterized by the human and personal interaction in which decisions is supported by a certain person, the teacher. It is a distinct instrument used to motivate groups, with the potential to transfer knowledge online, developing the concept of flexibility and user-friendliness.

This system does not rely upon spatial and temporal dimensions, because it aims at structuring the whole learning process by materializing links that make scattering impossible. This scattering is nowadays made possible by various sources.

As a result of what was referred above, the system overcomes the difficulties found in the state of the art, given that pedagogical obstruction is not verified or any other typology of interference in the vision field or even cascading of frameworks that lessen the pedagogical productivity in the development of the learning process, such as it is inferred in the patent request PI9805327-2.

Given this background, the criticisms of the concept of interactive learning and the flexible learning process do not apply to this invention. The present invention is unlike, for example, the Brazilian invention request patent PI9805327-2 and the international request PCT/US97/27572 that fail to include the interpersonal relationship

factor, crucial for the cognitive process and learning structure at the distinct levels of knowledge.

In the present system, user-friendliness occurs as a variable of success in the learning context, given that, at the different moments of individualized learning, the student can use of a group of possibilities to solve problems of different natures and knowledge sources, by accessing a wide variety of data base groups that are available. The entire system was created so that when a warning occurs, in a variety of forms, it can offer an adequate and professional solution. In this context, one of the approaches of personalized learning concept is developed due to a natural evolution of the tutorial methodology, the concerns with the optimal learning dimension, as well as the importance of academic experience as an essential part of the learning process.

Making information easily available and fluent is a great professional satisfaction among the traditional dimensions of the learning, whereby the aim is to optimize the temporal waste in communication by using more efficient systems. Thus, communicators have more time to efficiently deal with learning by introducing the needed improvements in methodology in a continuous effort to face the typical changes occurring in developed or developing societies.

The concept of self-directed learning that is supported by the Brazilian patent request PI9805327-2, indicates that the learner is the one who directs and organizes the personal learning process, without forgetting the increase of individual capabilities, through the simulated practice and the use of generalization models. This concept is something the present invention aims to improve through the development of a system whose methodology considers the teaching of attitudes extremely important, valuing the importance of citizenship and moral beliefs to develop a greater change of personal attitudes.

In this context, the teacher plays an important role in guiding, motivating, planning, advising, exchanging knowledge and mainly interpreting problems not only in the scientific area, but also the social one, changing attitudes and conducts, without forgetting the respect and freedom of the learner.

The structure of the entire system has to pass through the improvement of the individual or the group dimension, in which time is always considered necessary for a deep reflection on a certain topic or circumstance, without forgetting, when necessary, the attitudes of the anonymous person. Therefore, interaction in real time, open discussion and group dynamics are created to solve problems that appear even more with high incidences of complexity, common in societies in which the user-friendly concept is even more marginal.

This invention does not allow the isolation of the learner, given that, through the different sources of interactivity (information, graphics, films, animation, data bases) different problems can be solved immediately and directly from the learner's own workstation, through the improvement of the communication and learning concept in which not only is time saved but also where a closer contact between teacher and learner is permanently guaranteed.

The use of video cameras in the workstations with the consequent monitoring on the teacher's behalf allows him/her to reach a position of continuous pedagogical interaction with the learner, automatically creating a big process of quality: individualized lessons in a bi-directional learner/teacher relationship.

The system proposed here presents a group of resources that interact under the control of a manager (teacher, instructor), guaranteeing simultaneously a pluridirectional interaction and maximizing the benefits of the investment necessary for the development of the individual's learning. In short, besides stimulating the

individualized, the related system still allows a fast update from a vast quantity of supplementary information concerning the diverse contents of training and learning.

This system in itself allows the development of different typologies of layout, which associated to the evident interactivity generated by the actual system internalizes a truly dynamic position so necessary nowadays to face the changes that characterize all the typologies of interaction.

With the use of the system considered here, it arranges a group of resources that allow constant assistance to the learner in a bi-directional manner in the normal learning process. The elaborate structuring of the contents and the different interactive methodologies allow one to obtain a general and complete view of the entire course or even of the learner in an individualized manner in relation to creating a concept of personalized learning.

A synchronization of the resources is seen with the access to different sources of information, as well as with the possibility of total interaction between learners or even in a one for all view. All these factors lead to a possibility of all the learners high postures of instruction in the least amount of time possible, developing the individual's progress during the process.

The development of integration concepts causes different segments of learning (teachers, learners and contents) reach optimal levels of visibility and opportunities to receive a better education.

However, the educational methodology proposed here lacks a support of information and communication technologies that allow effective implementation of the same. Because the system does not allow for updated video and audio transmission technology on IP (Internet Protocol), the necessary conditions to support the entire

development of this methodology, the present system implements a hybrid support model of the particular multimedia contents.

A hybrid structure in which two distinct networks connect to a single system of management for transmission and reception of supported contents: a network on IP (Internet Protocol) and a video network.

In this context, the network on IP allows a transmission of contents on IP, making the transmission, reception and screening of the contents possible, where compression of the video in real time is not critical. The video network already allows a transmission of multimedia content in real time.

Brief Description of Drawings

Figure 1 is graphical representation of laboratory classroom.

Figure 2 is a schematic drawing of the communication between the central unit and the workstations.

Figure 3a is a bloc-diagram of the said image capturing system of a version of a teaching/learning classroom.

Figure 3b is a bloc-diagram of the said image capturing system of a second version of a teaching/learning classroom.

Figure 3c is a bloc-diagram of the said image capturing system of a third version of a teaching/learning classroom.

Figure 4 is a schematic representation of the layout of the workstations of the audio module.

Figure 5 is a schematic representation of the layout and connection of the workstations of the video module.

Figure 6 is a schematic representation of the layout and connections of the control module.

Figure 7 is a bloc-diagram of each individual student's workstation.

Figure 8 is a schematic representation of the audio and video of the auditorium module.

Figure 9 is a schematic representation of the audio and RGB of the auditorium module.

Figure 10 is a schematic representation of the control of the auditorium module.

Figure 11a is a schematic representation of the audio, video and control of a hypothetical auditorium.

Figure 11b is a schematic representation of the audio, video, and control of another hypothetical auditorium.

Figure 12 is a bloc-diagram of the links between audio, video and the control of a videoconference studio.

Figure 13 is a second bloc-diagram of the links between audio, video and the control of a videoconference.

Figure 14 is a bloc-diagram of the links between studio, auditorium and a clinic.

Figure 15 is a bloc-diagram of the links between the CODEC, public line and local network.

Best Mode for Carrying Out the Invention

The preferred embodiments to carry out this invention are going to be described below with reference to the drawings.

The audiovisual system implemented here basically does the following functions:

- Continuous visual monitorization, by the teacher/tutor, of the learners' work and their register on hard disk or VHS, just in case it is necessary;
- sharing of images created in a documents camera, in a S-VHS player or teacher's PC for the learners;
- holding a video conference; and
- learners access, from their own working stations, the existing data base on Intranet or on Internet, in such a way that allows practical work to be supplemented with information from these resources.

Each one of the workstations shown schematically in figure 1 will have as support equipment, a PC with, at least, a graphic card of cascading and video cameras.

In accordance with the preferred module in the context of this invention, each PC is made up of, at least:

- Processing unit, for example, Pentium III at 733 MHz;
- Ram memory of at least 128 Mb;
- A means to store data, at least an hard drive of 14Gb;
- Video card SVGA;
- Superimpose video card; and
- Card to connect the network, for example, a standard ethernet 10/100 network card.

As shown in figure 3b, each unit possesses central equipment made up of a video switching matrix, a multiplexer and a scanner converter that allows the teacher to

simultaneously see each learner's individual work by selecting four, nine or sixteen images according to the pattern the teacher chooses.

As the scheme of diagram of blocks in figure 3a and 3b suggests, the video cameras that exist at each working station are connected to the switching matrix by the multiplexer. Each multiplexer input displays an output, allowing the same camera to be connected to the input matrix, without reverting to the video server. The multiplexer has an output signal in which four, nine or sixteen images are available by configuring the referred multiplexer. This output of the multiplexer is connected to one of the inputs of the switching matrix. An output is used to connect the switching matrix to the teacher's monitor. The multiplexer and the matrix are connected to the teacher's PC by the serial port (Rs232) to allow its control using software developed for this effect.

Because 16 images are seen all at once on the teacher's monitor, and in accordance with the vertical resolution limits of the PAL system, whose line numbers are 625, the direct connection of that matrix output to the video monitor produces a undesirable flickering image. Therefore, it is necessary to have the signal pass through the scanner converter that allows the image to be reproduced on the monitor, whose horizontal and vertical resolution is superior to the resolution of the PAL system.

In this modality, a monitor with a resolution of 1280x1024 pixels was chosen to reproduce the image, this way avoiding, the flickering image. As one can see, this final vertical resolution (1024) exceeds a lot the vertical resolution of the PAL system. As mentioned previously, the solution to avoid flickering image is to connect the matrix output to the scanner converter, which amplifies the signal needed for the correct visualization of the teacher's monitor and the input of the S-VHS recorder to save classroom images.

To implement this solution, the teacher has a PC, which makes the management and switching of the signal sources to and from the learners and a monitor that is connected to the video-switching matrix. This PC allows the teacher to visualize all the work done by students in real time, exchange files and protocols using an internal network.

With this monitor connected to the video switching matrix, the teacher follows the learners' tasks in laboratorial work, in the use of a microscope, etc... .

The interface created allows the teacher, using his/her computer, to manage video sources and destinations coming from and directed to the learners. These come from cameras, from documents, from S-VHS and from videoconference.

Given the above description, the system presented here allows the connection of any input with any output, and therefore, making the functions mentioned above feasible.

Each PC, as already mentioned, contains an overlay video environment. This environment will automatically open a video window of variable resolution on the monitor with the start of the operational system of the learner's PC. This allows the learner to visualize a video image as well as have access to the internal or external databases of other window(s).

This video window can be resized (by the learner) or minimized/restored (by the teacher) when the need arises, allowing the learner in this way to use a bigger area in the display for searches.

The control of the audiovisual system is made by software installed in the teacher's computer. This control will be made through the serial ports and network card that connects the teacher's computer to the rest of the University's network. The

switching matrix is controlled by the teacher's computer through a serial port, as well as the multiplexer that has the same port.

Through the use of the network, the teacher can send contents to the learners' monitors, either individually or globally, as well as control by distance the different computers or even block them if necessary.

As seen in the scheme in figure 1, in the graphic interface of the control software a synoptic diagram of the laboratory is foreseen with a map of the learners' working stations and of the other components of the laboratory. The same software allows access to a data base of learners' pictures, organized by class(es), that will be charged at the beginning of each lesson and will put the picture of each learner in the working station s/he is at.

From his/her own working station the teacher can:

- see each learner's working station, of four learners, of nine or of sixteen learners, allowing each one of these ways of visualization be fixed or cyclical;
- see the performance of a specific learner, send it to other learners who receive it in their video window;
- send to learners the image of the desktop, images or video from the PC, video resulting from VHS or S-VHS, video resulting from the portable system of the internal or external videoconference;
- save on S-VHS or on hard disk drive the source of the video received.

To send images from one origin to one or many places, the teacher only needs to pull the input signal to the output, or group of outputs where one intends to send the signal.

In accordance with the preferred modality, this audiovisual system is divided in functional modules: training module, auditorium module and videoconference module.

Training Module:

Taking as an example the application of this system to a university dental clinic, the training module presents the following functional characteristics:

- configuration of the functionality of each specialty workstation according to the following modes: lesson, training, videoconference from one point to another, videoconference in two local points (auditorium module and training module) and from one to five remote points;
- the making of multipoint videoconferences (one local point and five remote);
- intercommunication of whatever specialty working station with the auditorium module;
- interconnection of the audiovisual system of the training module CODEC (Compression/Decompression) of the videoconference module.

The training module is made up of 38 working stations. Eight of these are specialty workstations that have added tasks. There also exists a place where an assistant is found, who through a touch screen, can set up and supervise the entire audiovisual system. The training module also has a central system that interconnects and controls all the existing equipment in the working stations.

Each specialty station possesses a video camera on top of the monitor, a computer whose monitor is connected to a superimpose video card, a switching matrix

with six inputs and two outputs, an electroacustic transducers, a means to save local video images and a group of functional devices of communication to allow the instructor the control of all the elements of the workstations.

The switching matrix of six inputs and two outputs has the following equipment inputs connected to it:

- video camera placed on top of the monitor (videoconference camera);
- for the dentists, intra-oral camera and a camera belonging to the dentist's glasses, for example, SundyGrendel glasses;
- central switching matrix output; and
- VHS recorder (output).

The #1 output of the switching matrix is connected to the overlay video card placed on the PC, and the #2 output is connected to one of the central switching matrix inputs.

The other working stations do not have all this equipment, since they are limited to the reception of images incoming of the control system and to a connection between the central system and the actual audio full duplex station, that is, in a communication mode that allows simultaneous transmission and reception in both directions.

The difference between the audio connection of these stations and of the specialty stations resides in the fact that the former connection is made by cable, while the latter is connected by radio frequency.

The schematization of figure 7 shows the elements that make up the non-specialty stations are: a computer with superimpose video card and a group of functional communication devices, preferentially, a group of three pedals, an audio device and a pre-amplifier for the audio device to amplify the audio signals.

The interconnection of the group of functional communication devices with the computer is made through the parallel port found on the computer. The PCs have two serial ports, a port to connect to the x-ray, and another to connect the central controller for receiving and sending commands.

The local control of each station is made by the local PC that has two or three serial ports, one of which will be connected to the couple matrix serial port to the specialty station, another to the x-ray equipment and finally a third will be connected to a central system controller port. The PC has a parallel port, which will be connected to three pedals. Each specialty station also possess full duplex audio devices.

As shown in figures 4 and 5, the central system is made up of a switching matrix with 64 video and audio outputs. This matrix allows all the workstations to be connected to the central system, and also connected to functional modules of the system by optical fiber. Each specialty station is connected to the switching matrix at the video level by a video input and a video output. The video input of the matrix coming from each station allows the central system to receive the incoming images of each one of the stations previously selected in the local matrix.

The video output of the central switching matrix related to each one of the stations serves so that each station receives the incoming images of the central system. Only the eight specialty stations are able to transmit video images to the central system. The other stations can only receive incoming images from the central system.

As shown in figure 4, all the other inputs and outputs of the switching matrix are connected to two optical fiber converters. One of them allows a connection of the training module to the auditorium one, and the other allows a connection of the training

module to the videoconference module. The video inputs and outputs of a CODEC place in order to perform videoconferences are also connected to this switching matrix.

At the audio level a connection between each station and the system central exists, through an audio input and output of the central switching matrix. The incoming audio signals from the workstations are signals originating from the electroacoustic transducers and makes it necessary to maintain the volume level these signals arrived at the matrix.

After verifying that the volume level is maintained, it is necessary to use an automatic gain control (AGC). That way, the incoming signal of each non-specialty working station goes first through a pre-amplifier to be transformed into a line signal and later goes through a device that maintains the level of the output constant (AGC).

The use of this controller allows the station to receive sound coming from the stations without having to constantly adjust the volume of the reception. Each station can even adjust the volume of the reception, which depends upon the auditory acuity of the user, who does not need to adjust the volume of the transmission, because that is done automatically.

The audio signal of the electroacoustic transducers of the specialty stations work differently. Similar to the other stations, the signal first goes through the automatic gain controller and next it will be applied to a two ways audio mix to be mixed with the original sound of an audio matrix output. The aim of this mixture is to be able to establish an audio full duplex communication between the specialty station and any other. The dialog between these two stations is heard by the other stations. This functioning is used when a group of stations are set up in lesson mode and when the learner intends to ask the teacher a question. In this situation a full duplex

communication should be established between the teacher and the learner that wants to ask the question and a simplex communication (in one direction at a time) with the other stations belonging to the lesson in order to encourage other students to participate in the dialog between the teacher and the other learner. When this situation is started the controller sends a group of commands to the switching matrix in order to connect the input of the microphone, belonging to the station of the learner who posed the question, with the mixer input of two channels, which is also connected to the microphone of the specialty station where the teacher can be found.

Another group of commands connects the matrix input, which is connected to the output of the mixer, with other station outputs that are set up to belong to the same lesson, in such a way that these can listen to the dialog without having the possibility to intervene immediately, although at any time they can ask for authorization to intervene. This management will be done by the teacher.

Similar to what happens to the video level, there exist inputs and outputs of this matrix that are connected to electro-optic converters. One allowing the connection of audio of the training module with the videoconference module, and the other, the connection of the audio with the local videoconference CODEC.

As seen in the schematization in figure 6, the control system of the training module is made up of a central controller and a touch screen. This controller has various serial ports interconnected to the PC of each station. Two more serial ports exist to interconnect the controller to the training module and the auditorium module and another serial port to connect the controller of the training module to the controller of the videoconference module. Another serial port exists to control the CODEC of the local videoconference module, and another to control the central switching matrix.

The training software has three modules for control: a resident in the central controller, one in the specialty stations and another in the other stations of the training module.

All the set up of the system, at a certain moment, resides in the controller of the training module just in case a problem occurs, like, for example, one of the computers of one of the stations suddenly be disconnected or for some reason the microprocessor is blocked, the system can continue to work with the other peripherals.

In case the computer is restarted, it automatically asks the central system, through a serial port, what is its current set up. As will be seen in detail next, the status referring to the multipoint videoconferences which use resources from the auditorium is also saved on the controller of the auditorium as well as on the controller of the training module.

The central controller has a touch screen interconnected that sets up the entire audiovisual system of the training module, except the videoconference that will be set up at the actual station.

This panel has a synoptic diagram design on it of the location of each one of the 38 stations, as well as its actual configuration (training, classroom, point to point videoconference or multi-point videoconference). It also has a device that can communicate with any one of the stations at any time to send an emergency message.

The visual interface of the specialty stations has two variants. One will be applied when the referred station is in the lesson or training mode and the other when it is in the videoconference or auditorium mode participating or not.

In the first variant, a synoptic of the training module appears on the computer screen that is similar to the synoptic of the touch screen so that the teacher can geographically

locate his/her learners, as was stressed before. Other than this synoptic, there also exists a cascade video window that allows the teacher to visualize the images from the sources of the signal that she/he is sending the learners. Each station is indicated by a rectangle and according to the color and symbol that the teacher has, it is possible to determine the present status of each learner station and at the bottom of the screen there are functions for each pedal.

The second variant of the visual interface is used for the videoconference mode. This visual interface is reduced to a video cascade window and to a subtitle indicating the functions of a set of computer keys, which allow the control of the remote CODEC as well as the functions of each pedal. The learners' stations will have an interface identical to the first variant but have fewer number of functions.

As was already mentioned, the configuration of the system in the training and lesson modes are made by a touch screen. To set up a group of stations for the lesson or training it is necessary to indicate through the touch screen, which specialty station is going to be part of the lesson or videoconference and which learner stations are part of the group.

Firstly, the supervisor designates on the touch screen the specialty station selected. With this, one of two possible windows opens. If the given station is not being used in videoconference, the window that opens shows two distinct icons that indicate to the supervisor if she/he wants to set up a given station to the training mode or the lesson mode. If the station is in videoconference mode, a window is shown with this warning.

If a specialty station needs to be configured to the training mode, all one has to do is select the window that contains the icon related to this configuration. Afterwards, the learners' stations that make up the group should be selected. If one station that already

belongs to another group is selected, a window opens with a message indicating that the station already belongs to a functional group. As soon as each station is accepted into a group, the control software inserts in the station an icon with the symbol of the specialty station.

In the modality being discussed, this mode should be used when the learners are at an advanced stage of their knowledge and when they already have enough knowledge to treat real patients. The goal of this mode is to allow the learner to call the teacher that supervises the class. At the learner's station, the right hand side pedal is used to call the teacher with normal priority, the middle pedal is used to immediately contact the teacher and the third pedal is used to delete any request made before.

When one works in this mode, the equipment used in the specialty station is only the system of wireless auditory means. In this case the pedals are not used.

When the learner activates the right hand side pedal, she/he transmits this information to the PC of the station by the parallel port and the PC transmits this information to the central controller of the system. Upon receiving this information, the controller sends the message to one of two mini disks that exist in the system. These mini disks are pre-recorded disks that contain 30 tracks each one, where the content of each track is a message that indicates the instructor to direct himself/herself to the station, whose number order is the same as the station number.

The reason why the two mini disks exist is the capacity of response of the system to the various requests so that to avoid that the necessary time between the request and the appearance to the doctor is minimized.

After the central controller receives the order from the station and identifies it, a cross point in the audio matrix is made to connect the output of the mini disk selected to

the input of the microphone base of the system belonging to the specialty station selected.

The second pedal is used to call the teacher in case of an emergency. When this request occurs, the others made through the mini disks are suspended and intercommunication is immediately established between the instructor and the given station. If another request is made, the system sends the request to another instructor; if another instructor is not present, as soon as the communication with the other station is over communication with the new station is immediately established.

In the lesson mode, a group of learners' stations is connected to a specialty station where a teacher can be found. When a group of stations are in this configuration an audio simplex communication is established through pattern between the specialty station and the learners' station. This connection is made by the switching matrix that connects the wireless microphone of the specialty station to the auditory sources of the learners' stations.

On the screen of the teacher's PC, as well as on the learners' screens, there exists a synoptic of this configuration. This synoptic, on the teacher's screen, will show the status of each learner's station, as far as the audio is concerned, that is, which learners want to intervene and his/her geographical location. As far as the learners' stations are concerned, this synoptic only serves to indicate what the current status of the system is, and does not have any interactivity with the teacher.

When any learner wishes to speak with the teacher, she/he should activate the left hand side pedal and wait until authorization to speak is granted. This authorization can unfold in two ways: one by the teacher pressing the right pedal, and the other by a

pointer device, for example, a mouse. The teacher simply has to touch the station she/he wishes to speak with.

While using the first method, the speaking turn is given to the stations in a sequential form, that is, the first station to ask to speak is the first to get a response. When they are allowed to speak, a full duplex communication is established between the specialty station and the learner's station.

Besides this connection, another connection is made with the other learners' stations in the simplex mode (the other learners only listen to the dialog between the teacher and their classmate). To end the dialog, the learner selects the left pedal again.

From this point on, the system returns to its initial state, that is, it is configured for a simplex dialog between the teacher and the learners. If the learner does not interrupt the dialog, the teacher can restore the original configuration of the system by activating the right pedal.

Besides the audio system in the lesson mode, a video system is also used to transmit video images to the learners from the specialty station. The teacher, during his oral lecture, may send incoming images from the video camera, from the Dvcam player, from the glasses camera or from the intra-oral camera. The right pedal is used to select these images in order to preview them, while the middle pedal is used for transmission purposes.

The videoconference configuration point to point is only valid for the specialty stations and allows communication with the exterior of the system using videoconference. The communication mode with the exterior can be made through ISDN or IP. Videoconference from any other location can be established by using a mobile CODEC.

The videoconference connection can be either point-to-point or multi-point up to five places. This type of videoconference can be made by using the local CODEC, which exists in the training module, or the CODEC, which exists in the videoconference studio. A optical fiber connection exists between the training module and the videoconference module. This connection is made at the video and audio level and rs232c (control).

To start a videoconference of this nature, it is necessary that the station is not previously configured for training mode or lesson mode. When the specialty station is not configured for any function, the synoptic of the training module is not present on the screen, what exists is an icon called videoconference that the user should select. Next, the controller tries to make a connection with the fixed CODECs: the training module CODEC and, if this is busy, the studio CODEC. If these two are busy, the system sends a message informing that the two studios are busy and therefore, it is not possible, at that time, to make the videoconference. If it is feasible, the central controller activates the visual interface that appears on the computer screen of the specialty station with the basic commands to control the CODEC. These commands are the left, right, up and down arrows and the permission to navigate in the system's menus. There also appear three other icons, which indicate the functions of each pedal. The left pedal allows the user to preview the image that is transmitted, the middle pedal to validate the transmission of the selected image, and finally the right pedal serves to commute in the zone of the biggest area of the screen between the local image and the remote one.

This last pedal is extremely important because when the user wants to send an image, she/he has to verify if it is in the best condition, therefore, she/he should see it in its total resolution, something that is not possible if it can only be seen in the 'pip' window of the system, that is, the necessary button to configure the cascade window. In

this situation, a cascade video window is opened through the video card that should have a resolution close to that of the video so that the instructor does not lose information.

In the videoconference multi-point mode, one or more training mode stations are connected to the auditorium module and optionally to the videoconference module. The group module of the auditorium, the training module stations and the videoconference module make up the multi-point videoconference system. This studio can also be connected to different places in order to allow various places in direct contact.

The configuration of this mode can come from the auditorium, clinic or studio modules. As will be specified next, in the auditorium panel the operator can select the configuration of the videoconference module, that is, its participants. When selecting these, the controller of the auditorium module is going to ask the controller of the studio about the possibility of connecting (this is only possible if the studio is not busy), and the controller of the training module to check if the stations previously requested are not working at that moment on another mode.

After the questionnaires are made, the controller indicates to the operator if it is possible to make all the configuration of the interconnections asked, or if on the contrary, any of the participants is not busy with another configuration. If it is possible, the controller returns to the operator of the auditorium module a message and sets up the system. In the specialty stations previously configured, a visual interface will be activated on the PC screen of the station with the functions available and possible for the teacher to control. In this configuration, the studio control is made by the control room.

The possible functions that can be controlled by the teacher are: the selection of the image that will be transmitted to the auditorium; and the intercommunication with the control room or with the instructor seated at the presidential table.

The visual interface on the PC screen consists of an icon that indicates to the instructor if the image and the sound of his/her station is on air, a warning icon that the control room or the instructor that is in the auditorium coordinating the operations wants to talk to the station. This possibility is only valid if the station is not involved in a transmission.

The pedal functions in this mode will also be marked on the screen. This way, the left hand side pedal serves to select the image to be transmitted, the middle pedal to select the image to be seen in the window of the biggest format (this possibility is necessary, because the user has to preview with quality the image to be transmitted) and finally the third pedal that serves for the user to ask to speak with the control room or with the coordinating teacher.

Auditorium

The auditorium module allows the implementation of the following functional characteristics.

- Reproduction on the giant screen the video images in VHS, S-VHS, Dvcam and Betacam sp formats;
- Capture, mixture, register and diffusion of the audio signals;
- Capture and register of the video images in the VHS, S-VHS, Dvcam and Betacam sp formats;
- Diffusion on the giant screen of the multimedia contents;

- Interconnection of the two auditoriums in such a way that these can work as an only one auditorium;
- Preview of the signal sources of the system (video and RGB);
- Transmission and reception in full duplex mode of video and audio signals to the training module;
- Realization of videoconferences through CODEC of the videoconference studio until transmission speeds of 512K with aggregation algorithm H221 or bonding (Bandwidth on Demand Interoperability);
- Control of the entire audiovisual system through three touch screens, one placed in the control room, another in the main auditorium, and another on the smaller auditorium stage;
- Intercommunication between the control room of the auditorium, stage and specialty stations.

As seen in figure 8, similarly to the training module, the main elements of interconnection of the system to the two auditoriums are two switching matrixes: one of video and the other audio. In these matrixes all the belonging equipment of the two auditoriums is interconnected and also the interconnections in optical fiber between the auditorium and the training module and between the videoconference studio and the training module.

To the referred matrix the following are also connected: video cameras, the video projectors and the monitors for pre-visualization of the image, as well as the video projectors and recorders of the two auditoriums.

A video matrix does the switching of all the video signals of the system with dimensions of 16 x 16 and a RGB matrix (that will serve to make the switching of the RGB and audio signals). This matrix has a bandwidth of at least 200 Mhz.

The need for such a high bandwidth comes from the need of the switching RGB signals coming from the PC (with resolutions of 1280 x 1024).

The signal sources that are reproduced on the giant screen are:

- S-VHS recorder;
- Betacam sp recorder;
- Dvcam recorder;
- Video cameras;
- Documents player;
- PCs connected to the network infrastructure;
- Remote images coming from the training module and the CODEC by the optical fiber system.

As was already mentioned, the system of matrixes is made up of two matrixes: one of low bandwidth (10 Mhz)destined to make video composed switching and also audio stereo, given that the matrix has a level of audio switching; and a RGB switching matrix with level of audio and of high bandwidth (200 Mhz). To reproduce the video signals on the giant screen, the control system sends a command to the video switching matrix, so to interconnect the matrix input corresponding to the equipment mentioned with the video projector input, this audio signal is directed to the audio output that is

connected to the audio table. This table allows, other than controlling the volume of this signal, a pre-equalization of the signal.

One of the auditoriums has, other than the projection system, a plasma monitor that allows the occupants of the table of presidency see what is happening on the screen, given that this is reproducing the image from the projector.

In each auditorium there are two system of audio broadcasting. One of these systems broadcasts the audio input coming from devices where this input has been previously recorded. The other audio system broadcasts the audio input captured by microphones. The first system is made up of two speakers placed laterally to the screen. The other audio system that is used to broadcast the sound captured by the microphones is made up of speakers placed on the ceiling, distributed uniformly. The reason why two types of sound amplification exist is justified by the fact that the optimization of the position of the speakers to the audio diffusion of the microphones is not the same for the diffusion of the incoming audio signals of the equipment. If the signals captured by the microphones are broadcasted by the audio signal speakers, the audio volume of the microphones must be increased, which causes undesirable noises in the auditorium. To avoid this problem, the audio signals of the device are broadcasted through the first system.

Directing the video and audio signals to be broadcasted in the auditorium is done in the following way: after the controller's register order, the controller sends a command to the switching matrix, in order to send the input device signal to the video projector and the audio signal to two pre-established inputs of the table. The signals that transport the image can be of two types: video or RGB. If the images to be broadcasted come from a S-VHS, the available signal is a video composed signal. If the image is from a Betacam, the signal is RGB. In the first case, the composed video signal comes

from the video matrix and this one has an output connected to the composed video input of the video projector. If, on the other hand, it is the Betacam image, the signal is sent by a RGB matrix that has one of its outputs connected to the RGB input of the projector.

The audio circuit has a similar philosophy as the video one, because it uses as its base an audio switching matrix. The main difference lies in that the audio tables do not have the microphones directly connected to its inputs, being each one of these connected to a pre-amplification circuit that is connected to the matrix inputs. This type of interconnection allows the microphones to be connected not only to the table of auditorium 1 but also to the table of auditorium 2. This functionality is necessary so that the system of the two auditoriums can work together or separately. When these work together, one table is used for the two auditoriums, using the table of auditorium 2 as a bypass, because it is easier to implement the system in this manner, when the two auditoriums are connected. This way, the volume control for the two auditoriums is made only by the table of auditorium 1.

The register of the audio sounds, as well as the register of the video signals, are made by the switching matrix, sending the font to be registered to the audio input or video recorder.

As philosophy of the system, the registered audio signals are broadcasted signals in auditorium 1. When auditorium 2 is interconnected, the audio signals to be registered include captured signals by the microphones of auditorium 2. If this auditorium is working separately from the rest of the system, the register of audio signals are not possible.

As mentioned previously, the registered signals are broadcasted signals in the auditorium. When the auditorium is configured with the most number interconnections possible, that is, with the training module, with auditorium 2, and with the videoconference module, the audio signal of the audio register is a mixture of local audio captured by the microphones of auditorium 1 with the audio signals captured by the microphones of auditorium 2, the incoming audio signals of the training module stations and finally the incoming remote audio signals of the videoconference module.

The implementation of these functionalities is relatively simple through the implemented interconnection model. Each audio table has 10 inputs paths and 12 outputs paths and as already mentioned all their outputs and inputs are connected to the matrix inputs and outputs.

The main auditorium can have the following interconnection configurations:

1. auditorium interconnected only to the training module;
2. auditorium interconnected to the videoconference module;
3. auditorium interconnected to auditorium 2;
4. auditorium interconnected to the training module and the videoconference module;
5. auditorium interconnected to the training module, the videoconference and auditorium 2.

When the auditorium is configured in mode 5 (it is not previously identified), the audio table inputs of auditorium 1 has 4 of its inputs interconnected to the auditorium's microphones, the next 4 to the microphones in auditorium 2, one to the incoming remote audio of the training module, and finally the other to the incoming audio of the videoconference module.

Table 1 outputs are interconnected by the switching matrix to the following points:

1 and 2 – front sound of auditoriums 1 and 2 (for auditorium 2 table 2 functions as bypass and inputs 1, 2, and 3 are used, as well as the same outputs that are interconnected with the respective inputs);

3 – conference sound for auditoriums 1 and 2;

4 – recording;

5 – audio signal to be transmitted to the training module;

6 – audio signal to be transmitted to the videoconference studio;

The audio signal present in output 1 and 2 is the sum of the audio signals coming from the videoconference module and the videoconference studio. Output 3 has the audio signal captured by the microphones in auditoriums 1 and 2. Output 4 (recording output) has a mixture of audio signals of the local auditorium 2 available, of the videoconference module, and the incoming audio of the training module. Output 5 will have a mixture of the audio signals coming from the microphones of the auditoriums and from the remote audio, which in turn comes from the CODEC videoconference. Finally, output 6 has the mixture of composed audio signals by the incoming audio of the training module and auditoriums 1 and 2. Therefore, to register the audio signals, all one needs to do is interconnect the audio inputs of the recorders with output 4 of the audio table that has a mixture of all the audio signals belonging to the auditorium available and to the other locations that at any time can be interconnected to the auditorium.

The audio system implemented between auditorium and training module allows an intercommunication of full duplex type between the auditorium and the specialty stations. Another connection made between the control room of the auditorium and the

presidency table and finally between the presidency table and the specialty stations. The method used in the intercommunication is similar to the one used in the training module and was implemented to the audio table of auditorium 2, given that it has available inputs and outputs. The inputs of this AGC are connected to audio devices and to electro-acoustic transducers in the control room and others on the presidency table so that the coordinator can communicate with other participants. The outputs of these controllers will be connected to the two matrix inputs. Two matrix outputs are connected to the auditory means by amplifiers for communication in the control room, or the training module with um of the specialty stations. The transmission of audio signals to the specialty stations are made by optical fiber, given that optical fiber displays a mono full duplex connection between the matrix of the training module and the auditorium module matrix.

The recording of video signals can be originated from the following equipment:

- the document player of the auditorium;
- captured images of the cameras in the auditoriums;
- images coming from the videoconference;
- images coming from the training module;

The images may be registered in the following formats:

- S-VHS
- Betacam SP

The recording of the S-VHS format and the Dvcam is made in composed video while the recording in Betacam SP is made in RGB. Therefore, it is necessary to convert the video signals into RGB signals so that they can be recorded. That function is carried out by the Extron demodulator. An output in the video matrix exists that is connected to the input of the converter. The output of this converter is connected to the input of the RGB matrix. This way, when a composed video image wants to be recorded in Betacam format, the controller sends commands to the switching matrixes in order for the video switching matrix sends the signal to the video source that it is recording for the matrix output where a demodulator is connected to an output that is connected to Betacam.

For the other formats, the recording is made in composed video. To perform this task the controller sends various commands to the video matrix in order to direct the video input to be recorded with the matrix outputs that are connected to the inputs of the S-VHS and Dvcam recorders.

The transmission of signals of the auditorium to the training module and to the videoconference module is made by optical fibers. Given that the transmission between the auditorium module and the training module are made only by composed video, all the images in RGB format (PC) have to be converted to composed video. The transmission of audio signals to the videoconference studio is made by interconnecting the output of the table to the electro-optic converter that is connected to the optical fiber of the training module and the studio module by the switching matrix.

In fact, and admitting that we are dealing with a configuration where the auditorium module is interconnected to the training module and to the studio (the other

configurations will be specific cases of this), the audio signals coming from the videoconference module and from the training module are sent to the audio 1 table by the switching matrix. Each signal enters a specific input of the audio table. The audio signal coming from the CODEC passes inside the audio table by an automatic gain controller to maintain the audio level constant. All the inputs of the table go through an automatic gain control for the same reasons mentioned, having the user of each one of the places only to regulate the volume of the general audio, that is, the audio resulting from the mixture of various signals.

Two broadcasting audio systems exist in the auditoriums: one to broadcast the audio of the video signal sources with the associated audio (VHS, Betacam and Dvcam). The audio coming from the training module, as well as the audio coming from the studio of the videoconference, is broadcasted by the ceiling speakers. The reason for this option is based on the minimizing echo from neighboring speakers in the microphone area.

The audio transmission to the training module is made by interconnecting the optical fiber with the output of table 5. The audio transmission to the videoconference module is made the same way, interconnecting to the output of table 6 with optical fiber that interconnects the audio and videoconference modules.

The control of the audiovisual system is made by the 3 control panels and a joystick. One of the control panels is in the control room and is considered the main panel, that is, it is the panel that configures the functioning mode of the auditorium module, and the interconnections between these: training and videoconference modules. The second panel and the third serve to allow the auditorium control of the stage area of both auditoriums 1 and 2. The control through these panels is simplified, that is, only one number reducing the functions is available.

Each panel, for implementation of all the control functions, displays a group of main keys and windows that occupy the entire dimension of the panel. The cascade windows occupy part of the dimension of the panel and are generated by the touch of a button belonging to the main window.

These panels possess the following implemented control functions:

- Configuration and selection of the audiovisual event to be developed in the auditorium at a given moment;
- Preview of the audio and video signal sources of the system;
- Selection of the image to be recorded;
- Selection of the image to be transmitted;
- Control keys of the devices;
- Intercommunication keys;

In order to facilitate the handling of the system, the configuration is only made at the beginning of each auditorium session. Given that this window is independent from the rest, the configuration window is implemented in a main window. The configuration of the system follows the configuration of various parameters that we will describe:

Configuration of the interconnection that defines to which locations the main auditorium is going to be interconnected, where the number of options is additive, that is, the final configuration is the equal to the sum of various selected options. The interconnection options are the following:

- small auditoriums;

- station 1 of the training module;
- station 2 of the training module;
- station 3 of the training module;
- station 4 of the training module;
- station 5 of the training module;
- station 6 of the training module;
- station 7 of the training module;
- station 8 of the training module;
- CODEC of the training module by redundancy;

Selection of the images of the monitor face, in which the images to be selected can be chosen by the touch panel of the control room in automatic mode or in the touch panel of the auditorium stage. This second option becomes important, when one intends to make transmissions from the training module to the auditorium module, and when the transmission is made on the stage. In these circumstances, the face monitor can act as a preview monitor of the captured images at each one of the stations. In the first mode, the reproduced image by the monitor is always an image that at a given instant is being reproduced in the video projector. Therefore, two disjunctive options exist in this item:

- the possibility or not to control the auditorium (only a few functions);
- the possibility or not to control the plasma monitor of the stage (preview the signal sources of the plasma monitor)

The control actions started by the selection keys associated to the control actions that serve to select what type of audiovisual event should be made at a certain instance in the auditorium depend on the way the system was initially configured. For example,

if the auditorium is in isolated mode, the controller limits itself to send an image from the VHS to the screen and the audio signal to the speakers of the auditorium. Oppositely, if the auditorium is interconnected to the studio, with the training module and with the videoconference studio, the controller has to send the audio and video signals to the referred locations.

In accordance with the modality chosen, the interconnection of the auditorium with other locations (small auditorium, and specialty stations) is seen as an extension of the main auditorium, and therefore, all the actions that are developed in the auditorium should be transmitted to the other locations and vice versa.

When the VHS function is activated, the controller sends a group of mode commands to make feasible the VHS projection on the auditorium screen and the sound of this is broadcasted by the speakers located laterally on the auditorium. If by configuration the auditorium is interconnected to the studio CODEC, specialty stations, or the small auditorium, the controller of the auditorium sends a video signal and an associated audio signal to the referred places. The transmission of the video and audio signals is made by the switching matrix to the various locations. The transmission of these signals to the CODEC and to the training module is made by sending the signals by optical fibers while for auditorium 2 the switching matrix is common to the main auditorium. The system allows in this configuration the use of electro-acoustic transducers and that their signal be transmitted between all the locations that are interconnected. In this configuration, the remote audio coming from diverse locations to auditorium 1 are in silent mode, by pattern, allowing the operator to higher the audio level. The Dvcam and Betacam sp recorders have an a system with identical features.

The PC functions are similar to those described earlier with the exception that RGB transmission signals do not exist and only composed video and audio. Therefore,

it is crucial to convert the RGB signals into composed video signals in such a way that they are transmitted to various locations. The conversion of these signals to video is made by the scanner converter that has its output connected to the video-switching matrix. Right away the controller only has to send commands to direct this input to the outputs of the matrix that are connected to the electro-optic converters that transport the signals to the studio of the videoconference module and to the training module. The video signals are processed similarly to the audio signals when we are in projection mode.

The opaque function keys, cam1 aud1, cam2 aud1, cam1 aud2, cam2 aud2, are identical as far as the configuration system is concerned, given that these are signal sources without associated audio. When whatever one of these keys are pressed, the controller sends commands in order for the matrix to send the signal source to all the locations that are interconnected to auditorium 1. The audio system configuration is identical to the other cases with the exception that the remote audio signals are activated. Given that the video and audio system only allows, at each moment, a video and audio full duplex communication with each station, in that configuration, and with other stations that, at the time, are interconnected to the auditorium, a video and audio simplex connection in the direction of the auditorium stations of the training module, only the selected station is able to interact with the auditorium. The CODEC of the videoconference studio will permanently be connected in the full duplex mode with the auditorium module.

The IREMVC, IREMBOXE1, IREMBOXE8 functions have a different philosophy of functioning. The objective with the prior functions was to send an image with associated audio or not from auditorium 1 to other locations and allow the audio signals to be sent and received from one of the locations to the others that are

interconnected to this auditorium. The way these keys work is a little different than the keys described earlier. While any of these keys are selected, the system limits itself to place on the auditorium 1 and 2 screen the remote image selected, not modifying the images that are being sent to the studio and to the stations.

As will be seen next, that function will be made by the transmission keys. The configuration of the audio system is identical to the opaque key function. The preview signal keys are used to preview all the audio and video signal sources that arrive to the auditorium. When anyone of these keys is selected, the controller sends commands to the switching matrix and to the scanner converter so that one can see the image on the preview monitor. Given that this monitor only receives RGB signals with horizontal scanner frequencies higher than 31.5 KHz, it is necessary to electrically adapt all the signals.

With the exception of the audio key, from the preview keys of the cameras and the opaque camera, the other function keys have identical behaviors, that is, when any one of these keys is selected the controller limits itself to send commands to the switching matrix in order to direct the audio signals to each location to the matrix output that is connected to the pre-amplifiers speakers.

In relation to the camera keys, to the opaques and the audio key, given that these do not display any associated audio source, the audio is a mixture of existing audio in the room at a certain moment. When the audio warning key is selected, everything will be processed in an identical way with the exception that this function key does not have any video source signal associated to it.

The recording keys serve to select the device whose signal is going to be recorded. The audio signal to be registered is a result of a mixture of various signals that

are being broadcasted in the auditorium at a certain moment of time. Activating one of these function keys, the controller sends a group of commands to the matrix, so that each one of the recorders has available to its input, the selected signal to record at that moment.

It is important to point out that the Betacam only records in RGB and therefore, when one wants to record opaques it is necessary to convert the composed video signal to RGB. This conversion is made by a special device.

The selected signal keys to be transmitted allow the operator of the system to select which image should be transmitted to the remote videoconference studio and to the stations that at a given moment are interconnected to the main auditorium. These keys will only be activated when in the selection keys of the audiovisual event are selected the IREM VIDEOCONFERENCE, IREM BOXE1, IREM BOXE2, IREM BOXE3, IREM BOXE4 IREM BOXE5, IREM BOXE6, IREM BOXE7, IREM BOXE8 functions, given that the other selection keys of the audiovisual event when activated send, to the locations that are interconnected with the auditorium, a certain signal source (for example, VHS, Betacam). When activating one of these keys the controller will start a group of commands to the various constituent devices of the system in order to send an image to be transmitted to various locations, specialty stations and videoconference studio. The image is sent to the location of origin so that the place of origin knows that it is its transmission that is being broadcasted and how this is being done.

The control keys of the devices interact only with a device or with a group of devices with analog control functions, that is, when selecting these keys, the controller only sends commands to only one device.

The REC, STOP, REW, PLAY, FFWD, PAUSE keys serve to control the transport function of the video recorders. These keys control whatever one of the recorders that exist in the system. The selection criteria is made by the selection keys of the audiovisual event and by the audio keys, remaining selected the recorder to be controlled by the last activated key among the selection keys of the audiovisual event and the audio keys. For example, if the VHS selected event key is activated and later on, the Betacam audio key, the control will be redirectionalized to control the Betacam. The volume keys are level keys that indicate what the level of device sound it refers to, as well as, wireless microphones, audio from the training module stations, and remote audio from the videoconference studio.

The joystick keys control all the camera functions. The joystick, as far as the selection of cameras to be controlled are concerned, is identical to the transport keys, with the exception that it is possible to control simultaneously, two video cameras. The selected cameras at a given moment are the last two selected among the selection keys of the audiovisual event and the preview keys.

The last functional keys group that we make reference to is the intercommunication keys group. These keys establish a point to point connection with one of the stations that is interconnected to the auditorium or to the presidency table. The system permits a simultaneous connection between any of the specialty stations and the stage and between the control room and another specialty station. In the touch panel of the control room as well as in the panel of the presidency table there exists a group of keys in which each key has indicated on it the place where an intercommunication is established if the button is activated.

Another particularity of the intercommunication is that it can only be made to a station that is not transmitting to the audiovisual system. After the key to where one

wants to intercommunicate is activated, this background color change remains fixed or alternates with the initial background color. When the background color changes and remains fixed, it means that it is possible to establish communication. If the background color does not remain fixed and at the end of 3 seconds will blink and go back to its original state.

The intercommunication keys have a certain background color according to the state of the intercommunication. Therefore, each key can present 3 background colors: the first is when no intercommunication exists with a given station, the second when the station that is communicating with another place and the third background color is when the given station is intercommunicating with a place that initiated the intercommunication. At the stations there also exists similar buttons on the computer screens that allow intercommunication to be made with the control room and with the presidency table. The difference is that these buttons are activated by function keys on the keyboard or with the mouse, while in the control room and at the presidency table the buttons are activated on the touch panel.

Videoconference

The videoconference module allows the following functionalities to be implemented:

- the creation of videoconferences in ISDN by adding H221 channels or bonding with transmission speeds up to 512 Kb;
- the creation of videoconferences upon IP with transmission speeds up to 1 megabit/second;

- the creation of multi-point videoconferences between 6 distinct places with transmission speed of 128 Kb/s or multi-point videoconferences up to 4 places with transmission speed of 384 Kb/s or 512K b/s;
- transmission of S-VHS images;
- transmission of PC images in graphic mode;
- reception and transmission upon ISDN and IP of video and audio signals coming from the auditorium module and the training module through the auditorium;
- transmission of video and audio signals directly from the specialty stations of the training module;
- direct connection between the auditorium module and the CODEC of the training module through the switching matrix, allowing redundancy of the CODEC of the videoconference.

The studio of the videoconference can work in the following operation modes:

- isolated – mode in which the videoconference is established with the outside and is neither interconnected with the auditorium nor with the clinic. In this mode one can still consider a particular situation, in which the studio is not in videoconferences, it serves only for local presentations by the plasma monitor;
- interconnected with the auditorium – mode in which the auditorium is interconnected to the videoconference studio. In this mode, the videoconference studio is limited to the reception and transmission of video and audio signals to and from the auditorium;

- interconnected to the clinic – identical to the latter mode, this mode is only different because the signals that are received and transmitted are video and audio signals coming from one of the specialty boxes.

- Isolated with interconnection between the auditorium and the CODEC of the clinic – identical mode to the first with the only difference that in simultaneous, the system provides the interconnection between the electro-optic converters of the clinic and the auditorium, so that the auditorium can be interconnected to the CODEC of the clinic.

As shown in figure 14, similarly to the auditorium, the main element of interconnection between the components of this system is a group of two switching matrixes, one used to switch video signals and the other to switch RGB signals. This switching matrix is a matrix of high bandwidth (200 Mhz to -3 db). The other matrix that is part of the integrating system is a matrix with a video level and another with an audio stereo level.

The system is made up of the following elements:

- Plasma monitor that is interconnected to the system of matrixes in the RGB and video levels and serves to broadcast the remote image or the graphic image when the studio is running in the graphic mode or in the non graphic mode. This monitor, given that its resolution is of 1024 x 1024, can also broadcast images directly from PCs that are connected to the system by a switching matrix.

- Crt monitor of 20 inches, that unlike the monitor just described, only has the possibility to reproduce video composed images. Its function in the system is to reproduce the local image, that is, the image to be transmitted.

- Scanconverter Sony DSC 1024 G

The preview of images in this system is made by the computer monitor with a resolution of 1280 by 1024 pixels, that is the maximum resolution expected for the PC to work in studio. Therefore, it is necessary to electrically convert all the signals to this format so that they can be reproduced by the monitor.

- Scanconverter extron VSC 100 that serves to convert the PC signals to be sent to videoconference. The output of this converter is connected to the Y/C input of the CODEC. The CODEC can transmit in graphic mode video images with a resolution of approximately 800x600. This mode allows the transmission of images frame to frame with the added advantage that the resolution of the image quadruples in relationship to the standard resolution of videoconference.

- The amplification sound system that serves to reproduce the audio signals in the system: the remote audio signal, the audio of the VHS, and the PC audio. Given the reduced dimensions of the room, it is not necessary to amplify the audio signal captured by the microphones. The amplification sound system is made up of an amplifier and two sound speakers.

- S-VHS recorder that serves to broadcast local images and also transmits them through the CODEC. In case it is necessary, this recorder can record a local image and a remote image or two simultaneously. Optionally, another recorder can be considered that only serves to record the system's images.

- Electro-optic converters that aim to interconnect the videoconference module to the auditorium and to the training module. The interconnection is made by the video, audio and rs232 signals. The transmission is full duplex for all types of signals.

- PC inputs (pc1, pc2, pc3) – these matrix inputs are used to connect the PCs to the system. So that the image is reproduced locally and also transmitted by the CODEC of the videoconference these signals have to be previously converted to y/c, as was already mentioned.

- Cameras 1, 2 and 3 that serve to capture images of the participants in the videoconference. Given that the number of seats in the studio is for five people, two of the cameras are configured to capture an image of two participants, while one of the cameras is configured to capture the image of the participant that is found in the middle of the table. The reason why each camera only captures a maximum of two participants is that the resolution of the videoconference images is of 320 by 240 pixels and if each camera captures more than two participants the image received in the remote studio does not distinguish with minimum quality the participants. The cameras used are of 470 horizontal lines of resolution.

- Audio mixer with canceling echo whose function it is to mix the audio signals coming from the microphones with any matrix signal source (S-VHS, PC) and transmit it to the remote studio. The audio coming from the remote studio by the CODEC is also processed by this table, and is directed to the amplification sound system or to one of the electro-optic converters in accordance with the actual configuration of the videoconference module. The third and last function is to promote the echo cancellation. The cancellation echo is made internally comparing the line signals that arrive directly to the table and to identical signals that arrive to the same by the electro-acoustic transducers. The system compares these two types of signals and removes this component of the incoming signal from the transducers only remaining the local voice component that will be

transmitted to the studio. Given this functioning mode, the reference signals have to be connected to the matrix independently from the audio signals captured by these transducers. For this reason, the incoming audio signals of the auditorium come separately between audio signals captured by the transducers and source signals from video signal (S-VHS, Betacam, Dvcam and remote image).

- CODEC of videoconference, that has the same technical characteristics of the CODEC of the videoconference studio in the training module, has two video connections for reception and two for transmission, given that the studio is always going to work in the configuration of the two monitors, that is, there always exists two monitors showing different images. When the system is working in graphic mode, one of the monitors reproduces a graphic image (a bigger monitor) and the other monitor (smaller one) reproduces the remote image. When the CODEC is not working in graphic mode, one of the monitors shows a remote image, while the other broadcasts a local image. Camera 4 is directly connected to the CODEC and its function is to give general plans to the room and capture the image of the participant that at a given moment is writing on the interactive board. This camera is motorized and controlled by the studio controller through the CODEC.

- Interactive Board – this board can be wrriten on with a special device and is equipped with a lazer ray system that through triangulation can detect the position of the marker. This board is controlled by a PC through a serial port. The reproduction of the image of the board is made in the output of the graphic card of the PC. This output is connected to the matrix input and can be broadcasted locally or transmitted in analogous mode to any PC.

- The control system is made up of an amx controller model accent 3 pro and by a touch panel model amx axt ca 10 whose function is to serve the interface with the user. This controller is the same as the auditorium one it has a group of various types of communication ports that allow an interconnection with the component equipment of the system. The interconnection between the controllers of the auditorium module, the training module and the videoconference module are made by optical fiber interconnecting ports rs232c.

Like the auditorium and training modules, the interface with the user is made by the touch panel where function keys are drawn. There are in this system the same types of function keys that exist in the auditorium. The functioning configuration of the system is partially made through the auditorium module and partially through the training module. If the studio is not in videoconference, and if the controller of the training module or de auditorium module sends a request to use the studio, this request is accepted by the controller of the videoconference studio. Upon accepting the request, the controller sends to the switching matrix a number of commands in order to direct the video and audio inputs and outputs of the CODEC to the electro-optic converters that interconnect the functioning modules. This way, the control of the studio will be made by the touch panel of the auditorium module or the training module, depending on the connection that is established. All the commands from the studio are made by the interconnection of optical fiber between these controllers.

Status keys are additional function keys that exist. The only objective of these keys is to indicate what the current status of the configuration of the videoconference module is. This information is very important since the user, who intends to use the studio, should know the state it is found in.

The performance of the selection of the audiovisual event keys for the videoconference module is identical to the performance of the same keys of the auditorium module with the exception of the conference key. When the studio is not in videoconference, and the conference function key is activated, the system will only work in recording mode. If we activate the recording function in the recorder, the image to be recorded will be manually selected (signal keys to be transmitted) or automatically through the activated voice method.

The configuration of the videoconference system is made by the following keys:

- Vconf (on, off) that allows configuration if the studio is going to work in videoconference or isolated.
- Selection mode of the camera to be transmitted (manual or automatic). These keys allow the operator to choose whether the selection of camera transmissions, in conference mode, are done manually or by voice activated.
- Pre-visualization of the signal keys: VHS; PC1; PC2; PC3; IREMOTA; CAMERA1; CAMERA2; CAMERA3; OPAQUES.
- Control device keys for the *pan* and *tilt* control of camera 4, zoom and focus: up arrow; down arrow; left arrow; right arrow; Zoom +; zoom; Focus +; Focus -;
- Control of CODEC keys that are used to control all the other functions: activate nominal telephone lists, dial telephone numbers, set up a new telephone number, allow the studio to enter in graphic mode and leave, hang up calls and set up a function of cascade window. To navigate the menu system of the CODEC the following function keys are needed: up arrow; down arrow; right arrow; left arrow; enter; return that allow the

implementation of all the functions mentioned, except to configurate the cascade window that needs a button, that here is called PIP, and that each time this button is pressed the window is sent to the next corner and after going through all the corners will disappear, only appearing the next time the same button is pressed. The visual interface that allows navigation appear, overlaps the local and remote images in the monitors. The activation of these keys is made when the preview keys are activated from the remote image key.

- Selection of the signal to be recorded keys that select if the image that should be recorded is an image to be transmitted or if it is a remote image. Whatever one it is, we should select if the graphic image or non graphic image should be recorded. The selection of the signal to be recorded keys is the following: remote image recording; image to be transmitted recording (local image); recording of the graphic image; recording of the non-graphic image.

- Selection of the image to be transmitted keys that are only activated when the conference key is selected, and is only available if the configuration is not chosen in automatic mode of the camera activation (by voice activated). The keys which belong to this functional group are the following: cam1 transmission, cam2 transmission; cam3 transmission.

Like the scheme presented in figure 14, the training, auditorium and videoconference modules are interconnected by video, audio and control (rs232c) signals in both directions (full duplex). The interconnection is made in optical fiber multimode, given that this means has two advantages, which are: allows the galvanic detachment between the various locations (training, auditorium and videoconference

modules) and reduce the loss of signals coming from big distances, maximizing therefore, the transmission of signals. With the use of this means, electrical inductions are also avoided that can exist in the route of some locations to others.

As can be seen in the diagram of blocks in figure 15, redundancy exists in the connections. This redundancy serves, in case of failure, to use an alternative connection. In fact, given the configurations already described, it is necessary to make videoconferences between the training module and the exterior using a CODEC location. Therefore, if the CODEC is not in operation, it is necessary to foresee an alternative solution, given that this type of videoconference can be of great importance, like for example, in the surgical interventions that are being accompanied by a specialist at a distance. This alternative is made through the CODEC of the videoconference studio, using a optical fiber connection between the training module and the videoconference module.

A similar situation can occur with the auditorium module. This module uses primarily the CODEC of the videoconference module. The auditorium module uses the optical fiber system that interconnects the auditorium and videoconference modules. If, for any reason, the CODEC of the videoconference module is not operating or busy, the controller of the auditorium can promote the interconnection of this auditorium with the CODEC of the training module. This interconnection can be made by optical fiber that directly connects the auditorium and training modules or by using an optical fiber ring, the ring can interconnect the auditorium module with the videoconference module, therefore, the ring that interconnects the videoconference module to the training module. The videoconference module will use, in a special situation, its own CODEC. Nevertheless, if this is not operating or busy, it can use the CODEC of the training module.

Therefore, we can conclude that in order to run videoconferences of any one of the functioning modules of the system there will always be a redundancy of routes and CODECs.

The audiovisual system made up of the auditorium, training and videoconference modules forms a system, in which the three elements are interconnected amongst themselves. This affirmation is only valid as far as video and audio signals are concerned, given that the PCs in the workstations are connected by network and as such may be accessed from the exterior.

As shown in figure 15, communication with the video and audio external system is made by the CODECs of the training module and the videoconference module by the ISDN lines or by the network (IP). If the RDI interface is used each CODEC displays a multi-point unit that allows this type of videoconferences to be made between four locations at a speed of 384 or 512 kb/s, or even six locations at a speed of 128 kb/s.

Therefore, this system can be interconnected to various remote locations, simultaneously, allowing conferences to be broadcasted or acts of controllers to various locations. If the connection is made by the local network, the connection can be made at a maximum speed of transmission of 1 Mb/s. The studios do not have multi-point capacity, with the local network therefore, a multi-point unit that runs on IP becomes necessary. Through this unit we can provide multi-point connections, in order to maintain identical functionalities similar to the ones that can be achieved by ISDN.

When one wants to effect multi-point videoconferences, in which some of the locations do not belong to the training module and therefore, cannot use the local network, it is necessary to make available a device that allows the implementation this functionality. To implement this functionality we use an ISDN gateway for IP.

Consequently, the remote locations to be connected by the ISDN make the connection to the telephone numbers which belong to the gateway, and this gateway converts the protocol using ISDN for IP.

The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit scope of the invention and all modification are intended to be included within the scope of the following claims.

CLAIMS

1. Interactive Teaching/Learning System, that provides the materialization of a learning network in which knowledge is transferred in real-time between the parties involved and provides a pluri-directional interaction between instructor and learners; this system being made up of at least the following items:

- A processing unit, preferably "client", having at least an overlay video card and a network adapter card;
- A processing unit, preferably "server" that, by the serial ports and at least one network card, is interconnected to at least one slave processing unit, a multiplexer and a scanner converter; and
- A switching video and audio matrix that interconnects the mentioned units.

2. System according to claim 1, wherein the referred video switching matrix is connected to the video cameras connected directly to the multiplexer, whose inputs have an output that connect the same camera to the only input of the matrix.

3. System according to claim 1, wherein the slave processing unit allows access to the various databases.

4. System according to claim 1, wherein the audio and video switching matrix is coupled to the central processing unit.

5. System according to claim 1, wherein the audio switching matrix receiving audio signals generated by means of electro-acoustic transducers with constant volume.

6. System according to claim 1, wherein the system uses a hybrid communication structure in which two distinct networks of information

merge into one only management system for transmission and reception of supported contents, preferably, by a network about IP and by a video network.

7. System according to claim 1, wherein the central unit allowing the simultaneous visualization of each individual learner's work or at least in four, nine or sixteen images by the configuration of the multiplexer.

8. System according to claim 1, wherein the signal passes through the scanner converter that reproduces, simultaneously, the learners' image on the monitor, whose horizontal and vertical resolution is superior to the resolution of the Pal system, amplifying the necessary signal to the correct visualization of the images.

9. System according to claim 1, wherein the system foresees the interconnection of any audio and video input with any video and audio output.

10. Interactive Teaching/Learning System, containing functional modules interconnected amongst themselves, wherein the training module presents the following characteristics:

- Configuration of the working stations according to the modules of the system;
- Intercommunication between the means of the system; and
- Interconnection between the functional modules.

11. System according to claim 10, wherein the working stations are related to training, lesson and videoconference modules.

12. System according to claim 10, wherein the intercommunication is made between the specialty workstations and the auditorium module and is made between the workstations in themselves and the exterior.

13. System according to claim 10, wherein the training module is made up of at least:

- eight specialty working stations associated to the video and audio switching matrix, with at least six inputs and at least two outputs and have a video camera, a superimposed video card, recording, listening and electro-acoustic transduction means and a group of functional devices interconnected to that switching matrix by a parallel port;
- thirty workstations containing a video camera, a computer with a superimposed video card, a group of functional devices of communication between the workstations, and transducer; and
- a central controller made up of an audio and central video switching matrix with 64 inputs and 64 outputs for connection.

14. System according to claim 13, wherein the switching matrix outputs of the workstations are connected to the superimposed video card and at least one of the central switching matrix inputs.

15. System according to claim 13 or 14, wherein the audio connection, between the workstations and the central controller, include a communication module that allows the simultaneous transmission and reception in both directions.

16. System according to claim 15, wherein the audio connection between the workstations is made, preferably by cable, the connection of the stations to the specialty workstations preferably made by radio frequency.

17. System according to whatever one of the claims from 10 to 16, wherein the audio signal generates in the specialty workstations to be applied to the automatic gain controller and next applied to a mixer of two ways that mix the signal with the signal coming from the output of the audio matrix,

allowing full duplex communication between the specialty workstations and the other workstations.

18. System according to claim 10 to 17, wherein the inputs and outputs of the switching matrix associated to the specialty workstation are connected to the electro-optic converters.

19. System according to claim 10, wherein the central controller contains a touch panel that has various serial ports interconnected to the PC of each station, at least another serial port to make possible the interconnection between the controller of the training module and the controller of the auditorium module; at least another serial port to make possible the interconnection between the training module and the videoconference module; at least one serial port to control the CODEC of the local videoconference; and at least another port to control the central switching matrix.

20. System according to claim 13, wherein the intercommunication between the workstation and the specialty station be made by a group of functional devices of communication, preferably, a group of pedals, in which:

- The right pedal for normal priority contacts;
- The middle pedal for immediate contacts;
- The left pedal to cancel any one of the other contacts.

21. System according to claim 13, wherein the intercommunication between the specialty workstation and the exterior is made by the ISDN or the network from the group of functional devices, preferably the group of pedals, in which:

- the left pedal is to preview the image transmitted;
- the middle pedal to validate the transmission of the selected image; and

- the right pedal to switch the zone with the biggest area of the screen with the local image and the remote image.

22. Interactive Teaching/Learning System containing functional modules interconnected between each other, wherein the auditorium module presents the following functional characteristics:

- Treatment of video and audio signals;
- Treatment of video images;
- Control of the audiovisual system; and
- Intercommunication between the means of the system.

23. System according to claim 22, wherein the other treatments are types of caption, mixture, register and broadcasted video and audio signals; the transmission and reception, in full duplex mode, of video and audio signals of the training module.

24. System according to claim 22, wherein the control of the audiovisual system is by touch panels.

25. System according to claim 22, wherein the intercommunication is between the control room of the auditorium, the stage and the specialty workstations.

26. System according to claim 22, 23, 24 or 25, wherein the auditorium module is made up of at least:

- Two video and audio switching matrixes, interconnecting the functioning modules between themselves and connecting video cameras, video projectors, monitors for pre-visualization of images, as well as recording means;
- Touch control panels, means of recording, video cameras and document players.

27. System according to claim 22, 23, 24, 25 or 26 wherein the caption and register of video image are reproduced on the giant screen in VHS, S-VHS, Dvcam and Betacam sp formats.

28. System according to claim 22, 23, 24, or 27 wherein the signal sources reproduced on the giant screen are preferably originating from:

- S-VHS recorder;
- Betacam sp recorder;
- Dvcam recorder;
- Video cameras;
- Document player
- PCs connected to cement boxes; and
- Incoming remote images of the training clinic module and of the CODEC by the optical fiber system.

29. System according to claim 22 or 24, wherein the interconnection between the two auditoriums are made in such a way that these work as though one only auditorium.

30. System according to claim 22, characterized by the fact that foreseeing the making of internal videoconference about IP to 1 Mb or external about IP or ISDN with transmission speed up to 512k.

31. System according to claim 22, wherein one of the switching matrixes has a low bandwidth, preferably 10Mhz, for video composed and audio stereo switchers and by the fact that the other switching matrix is a RGB matrix with audio level and high bandwidth, preferably 200Mhz.

32. System according to whatever claim 22 and 31, wherein two audio broadcast systems are foreseen. The first broadcast the audio, whose device is made up

of two speakers placed laterally to the screen. The second one broadcasts the audio captured by the electro-acoustic transducer made up of speakers uniformly placed on the ceiling

33. System according to claims 18 or 25, wherein the outputs of table 1 are interconnected by the switching matrix to the following points:

- 1 and 2 – frontal sound of the auditoriums 1 and 2;
- 3 – conference sound for auditoriums 1 and 2;
- 4 – recording
- 5 – audio signal to transmit to the training module;
- 6 – audio signal to transmit to the videoconference studio;

34. System according to claims 22, 32 or 33, wherein:

- The audio signal present in outputs 1 and 2 are the sum of the audio signals coming from the training module and of the videoconference module;
- Output 3 has the audio signal captured by the electro-acoustic transducers of auditorium 1 and 2;
- Output 4 has a mixture of audio signals of the local auditorium, auditorium 2, of the videoconference module, and of the audio coming from the training module;
- Output 5 has a mixture of audio signals available of the transducers of the auditorium and of the remote audio of the CODEC of the videoconference; and
- Output 6 has a mixture of audio signals made up of a mixture of audio coming from the training module and from auditoriums 1 and 2.

35. System according to claim 22, wherein the transmission of audio signals to the specialty stations is made preferably by optical-fibre.

36. System according to whatever one of the claim 22 to 31, characterized by the fact that the recording video signals are from the following equipment:

- Document player of the auditorium;
- Captured images from the cameras of the auditoriums;
- Incoming images from the videoconference studio; and
- Incoming images from the training module.

37. System according to claims 22, 23, 24, 25, 26, 27,28, 29, 30 or 31, wherein the recording in SVHS or Dvcam format are made in composed video and Betacam sp recording made in RGB.

38. System according to claim 22, wherein the audio signals coming from the videoconference and training modules are directed to the audio table by the switching matrix.

39. System according to claim 22, wherein the control of the auditorium modules is made by the three control panels and a joystick.

40. System according to claim 39, wherein the panels possess the following control functions implemented:

- Configuration and selection of the audiovisual event to happen in the auditorium at a certain moment;
- Pre-visualization of the sources of the audio and video signal of the system;
- Selection of the image to be recorded;
- Selection of the image to be transmitted;
- Control keys of the devices;
- Intercommunication keys;

41. System according to claim 22, wherein the configuration of the auditorium module is made, preferably, at the beginning of each session, obeying the following parameters:

- Configuration of the interconnection, defining the locations of the main auditorium are going to be interconnected;
- Selection of the monitor images chosen by the touch panel of the control room of the auditorium or the touch panel of the stage of the auditorium;
- Configuration of the touch panel of the main auditorium, to control the auditorium and the plasma monitor of the stage;

42. System according to claim 22, wherein the touch panels have at least the following keys and functions:

- S-VHS;
- Betacam;
- Dvcam;
- PC1 AUD1;
- PC2 AUD1
- PC3 AUD 1;
- PC1 AUD 2;
- PC2 AUD 2;
- OPAQUES;
- CAMERA 1 AUD 1;
- CAMERA 2 AUD 1;
- CAMERA 1 AUD2;
- CAMERA 2 AUD 2;
- IREM ESTUDIOVC;
- IREM BOX1
- IREM BOX2
- IREM BOX3

- IREM BOX4
- IREM BOX5
- IREM BOX6
- IREM BOX7
- IREM BOX8;

43. Interactive Teaching/Learning System containing functional modules interconnected amongst themselves, wherein the videoconference module presents the following functional characteristics:

- The making of videoconferences;
- Treatment of images;
- Treatment of video and audio signals; and
- Intercommunication between the means of the system.

44. System according to claim 43, wherein the treatments are of transmission image, transmission and reception of video and audio signals directly from the specialty workstations and the treatment module.

45. System according to claim 43, wherein the intercommunication is connected directly between the auditorium module and the CODEC of the training module;

46. System according to claim 43, wherein the videoconference module has at least:

- Two video and audio switching matrixes with distinct bandwidth;
- A plasma monitor interconnected to the matrixes at the RGB and video levels;
- Crt monitor whose function is to reproduce the local image that will be transmitted;
- Scanner converters

- Amplification system counting with at least one amplifier and two sound speakers;
- Recording means;
- Electro-optic converters that interconnect the functioning modules of the system by audio, video and rs232 signals;
- Video cameras that capture images of the participants of the videoconference;
- Audio mixer with echo canceller that mixes audio signals coming from electro-acoustic transducers means with whatever signal of the matrix;
- CODEC;
- Interactive board that counts with a special device for equipped writing with a laser rays system that detects the position of the marker;
- Controller and touch panel that provide an control interface for the user;

47. System according to claim 46, wherein the videoconference module has at least the following operation modes:

- Isolated, where the videoconference module is not interconnected to the auditorium module nor to the training module;
- Interconnected to the auditorium module, where the auditorium is interconnected to the videoconference module;
- Interconnected to the training module, where this module is interconnected to the videoconference module and the signals to be received and transmitted are video and audio signals coming from the specialty workstations;
- Isolated with an interconnection between the auditorium and the CODEC of the training mode, where the interconnection between the electro-optic converters of the training module and the auditorium is arranged so that the auditorium is interconnected to the CODEC of the training module.

48. System according to claim 46, wherein the switching matrixes have a high bandwidth, preferably 200 MHz to -3db, for RGB switching signals, and by the fact that another switching matrix is a matrix with audio level and another with audio stereo level.

49. System according to claim 46, wherein the configuration of the videoconference module consists of at least the following keys:

- Vconf (on, off);
- Selection mode of the camera to be transmitted;
- Preview keys of the signal: VHS; PC1 PC2; PC3; IREMOTA; CAMERA 1; CAMERA 2; CAMERA 3; OPAQUES
- Control keys of the devices to control *pan* and *tilt* of camera 4, zoom and focus: up arrow, down arrow, left arrow, right arrow; Zoom +; zoom; Focus +; Focus -;
- Control keys of CODEC to control all the CODEC functions;
- Navigation keys in the menu system of the CODEC: up arrow, down arrow, left arrow, right arrow; enter; and return;
- Selection of the signal keys to record for selection;
- Selection of the image keys: Transmission cam1; Transmission cam2; Transmission cam3.

50. System according to claim 51, wherein the software of control allows the virtual button that when activated places the video cascade window to the next corner and after going through all the corners, disappears, returning only to appear again the next time the button is pressed.

51. Interactive Teaching/Learning System, in which software of control installed in the central unit is the software allows the control of the system by its own central processing unit.

52. Interactive Teaching/Learning Method where the materialization of network learning concept, feasible by the communication between teachers and learners, is clearly facilitated from the online knowledge transfer characterized by the fact that the method is feasible from the use of the system.

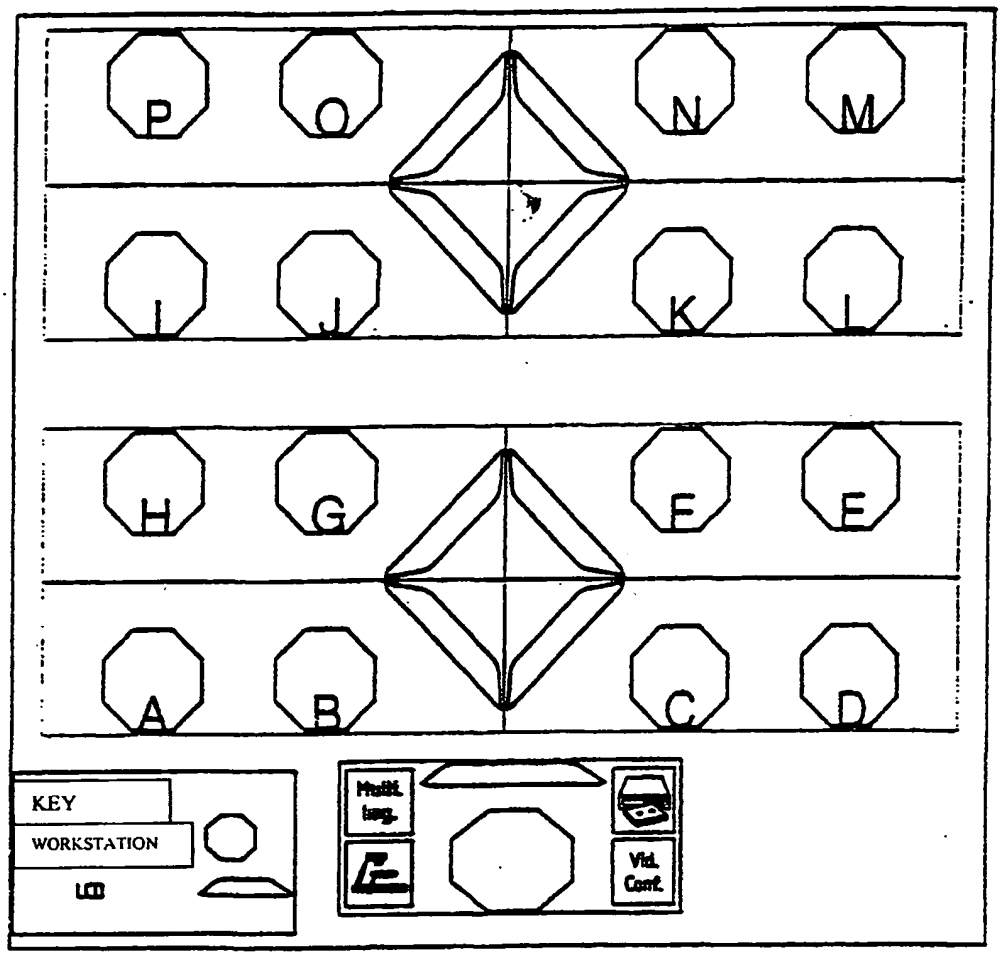

FIG. 1

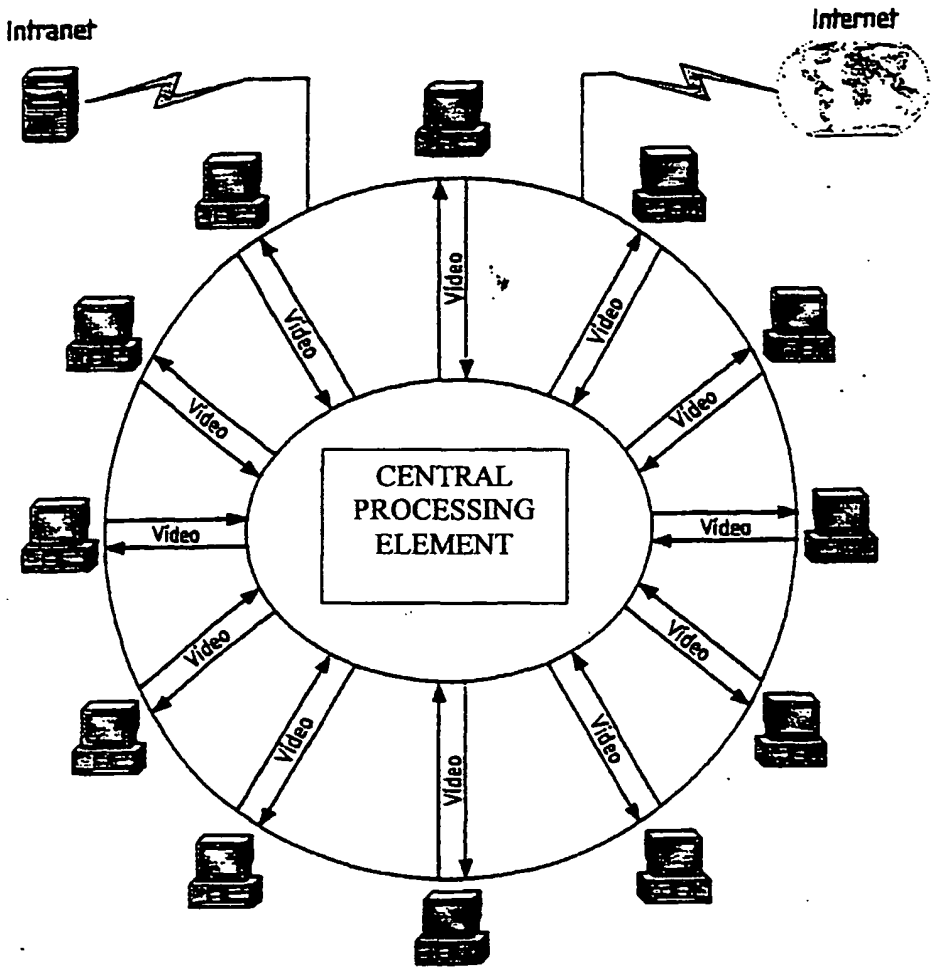
Intranet
Internet
CENTRAL PROCESSING ELEMENT
Video
Video
Video
Video
Video
Video
Video
Video
Video
Video
Video
Video

FIG. 2

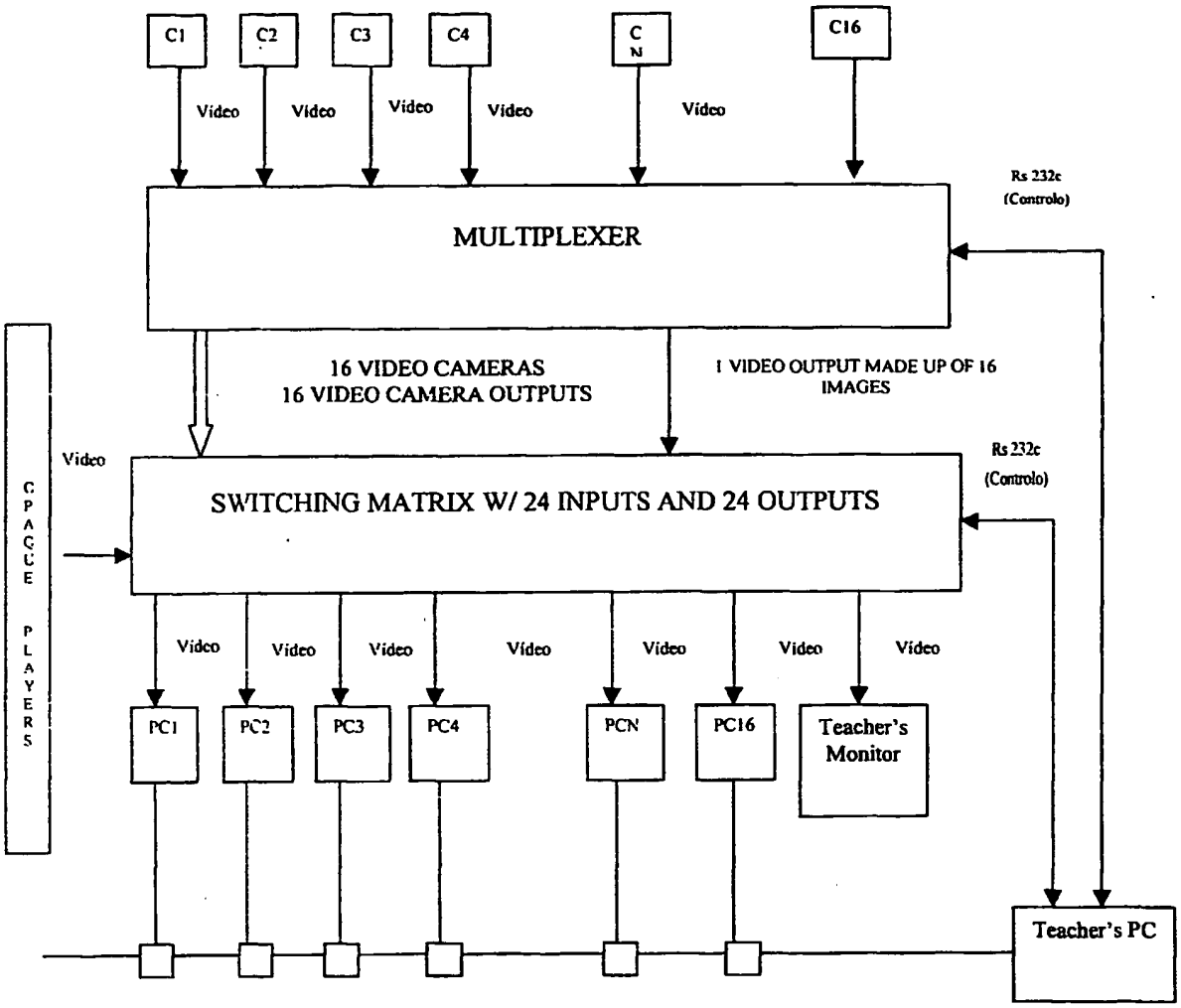
C1
C2
C3
C4
C N
C16
Video
Video
Video
Video
Video
Rs 232c (Controlo)
MULTIPLEXER
16 VIDEO CAMERAS
16 VIDEO CAMERA OUTPUTS
1 VIDEO OUTPUT MADE UP OF 16 IMAGES
Video
Rs 232c (Controlo)
SWITCHING MATRIX W/ 24 INPUTS AND 24 OUTPUTS
CPACUE PLAYERS
Video
Video
Video
Video
Video
Video
Video
PC1
PC2
PC3
PC4
PCN
PC16
Teacher's Monitor
Teacher's PC

FIG. 3a

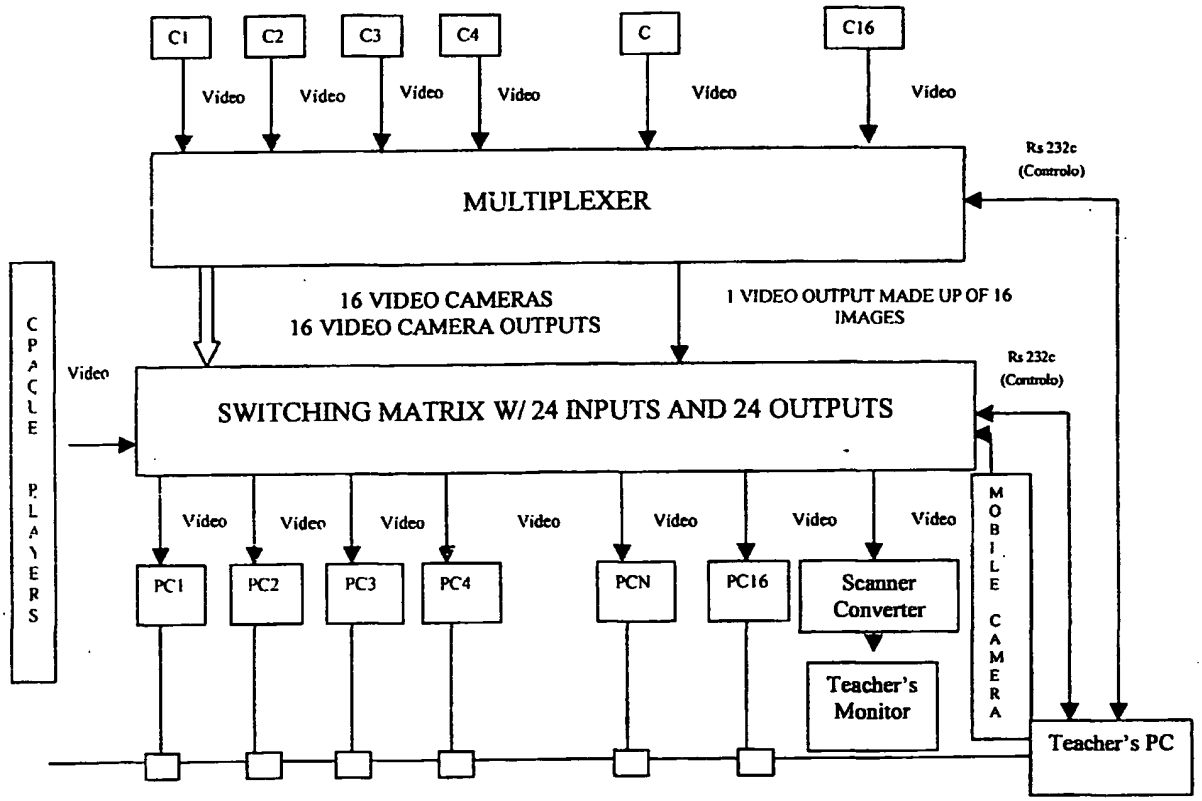
C1
C2
C3
C4
C
C16
Video
Video
Video
Video
Video
Video
Rs 232c
(Controlo)
MULTIPLEXER
16 VIDEO CAMERAS
16 VIDEO CAMERA OUTPUTS
1 VIDEO OUTPUT MADE UP OF 16
IMAGES
CPACLE PLAYERS
Video
Rs 232c
(Controlo)
SWITCHING MATRIX W/ 24 INPUTS AND 24 OUTPUTS
Video
Video
Video
Video
Video
Video
Video
MOBILE CAMERA
PC1
PC2
PC3
PC4
PCN
PC16
Scanner
Converter
Teacher's
Monitor
Teacher's PC

FIG. 3b

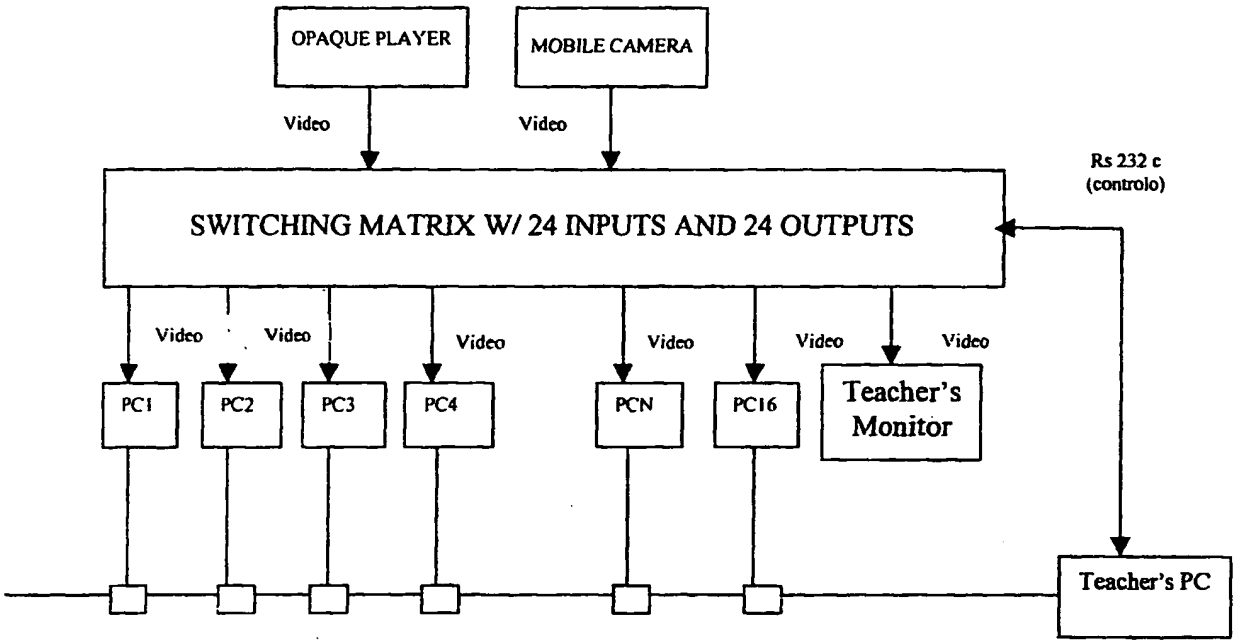
OPAQUE PLAYER
MOBILE CAMERA
Video
Video
Rs 232 c
(controlo)
SWITCHING MATRIX W/ 24 INPUTS AND 24 OUTPUTS
Video
Video
Video
Video
Video
Video
PC1
PC2
PC3
PC4
PCN
PC16
Teacher's Monitor
Teacher's PC

FIG. 3c

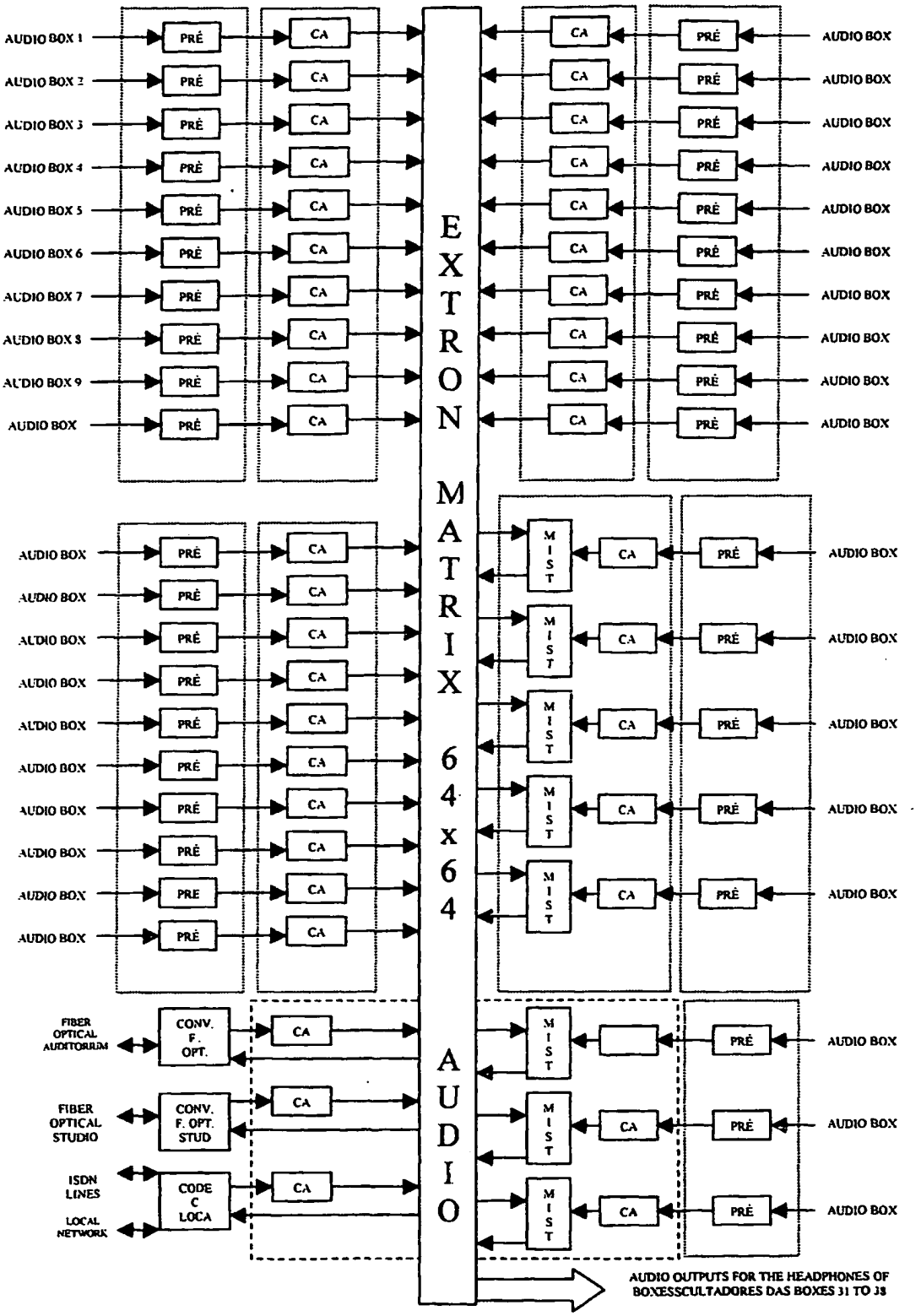
AUDIO BOX 1
AUDIO BOX 2
AUDIO BOX 3
AUDIO BOX 4
AUDIO BOX 5
AUDIO BOX 6
AUDIO BOX 7
AUDIO BOX 8
AUDIO BOX 9
AUDIO BOX
PRÉ
CA
EXTRON MATRIX 64x64 AUDIO
MIST
FIBER OPTICAL AUDITORIUM
CONV. F. OPT.
FIBER OPTICAL STUDIO
CONV. F. OPT. STUD
ISDN LINES
LOCAL NETWORK
CODEC LOCA
AUDIO OUTPUTS FOR THE HEADPHONES OF BOXESSCULTADORES DAS BOXES 31 TO 38

FIG. 4

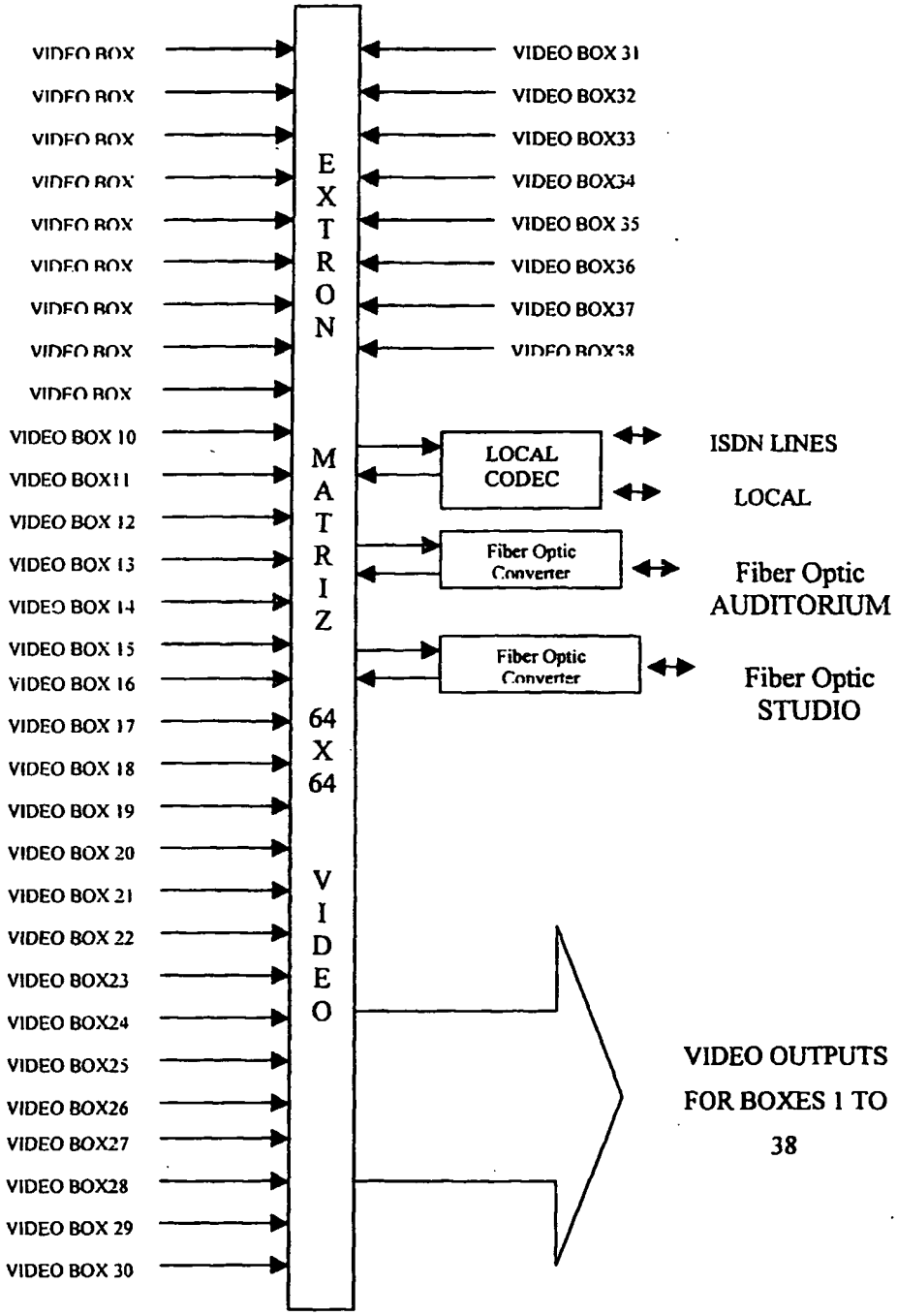
VIDEO BOX
VIDEO BOX
VIDEO BOX
VIDEO BOX
VIDEO BOX
VIDEO BOX
VIDEO BOX
VIDEO BOX
VIDEO BOX
VIDEO BOX 10
VIDEO BOX11
VIDEO BOX 12
VIDEO BOX 13
VIDEO BOX 14
VIDEO BOX 15
VIDEO BOX 16
VIDEO BOX 17
VIDEO BOX 18
VIDEO BOX 19
VIDEO BOX 20
VIDEO BOX 21
VIDEO BOX 22
VIDEO BOX23
VIDEO BOX24
VIDEO BOX25
VIDEO BOX26
VIDEO BOX27
VIDEO BOX28
VIDEO BOX 29
VIDEO BOX 30
EXTRON
MATRIZ
64 X 64
VIDEO
VIDEO BOX 31
VIDEO BOX32
VIDEO BOX33
VIDEO BOX34
VIDEO BOX 35
VIDEO BOX36
VIDEO BOX37
VIDEO BOX38
LOCAL CODEC
ISDN LINES
LOCAL
Fiber Optic Converter
Fiber Optic AUDITORIUM
Fiber Optic Converter
Fiber Optic STUDIO
VIDEO OUTPUTS FOR BOXES 1 TO 38

FIG. 5

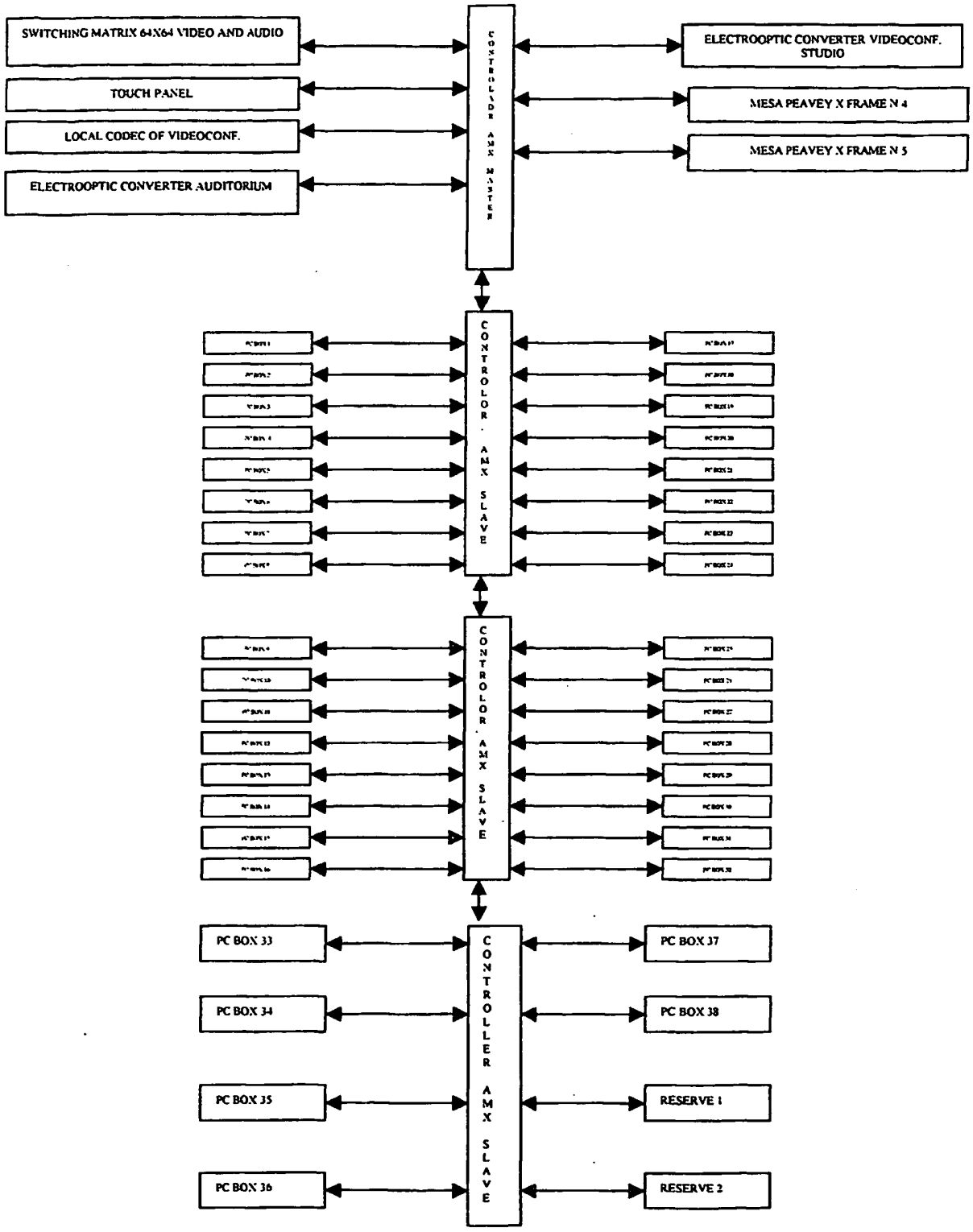
SWITCHING MATRIX 64X64 VIDEO AND AUDIO
TOUCH PANEL
LOCAL CODEC OF VIDEOCONF.
ELECTROOPTIC CONVERTER AUDITORIUM
CONTROLADOR AMX MASTER
ELECTROOPTIC CONVERTER VIDEOCONF. STUDIO
MESA PEAVEY X FRAME N 4
MESA PEAVEY X FRAME N 5
CONTROLOR AMX SLAVE
CONTROLOR AMX SLAVE
PC BOX 33
PC BOX 34
PC BOX 35
PC BOX 36
CONTROLLER AMX SLAVE
PC BOX 37
PC BOX 38
RESERVE 1
RESERVE 2

FIG. 6

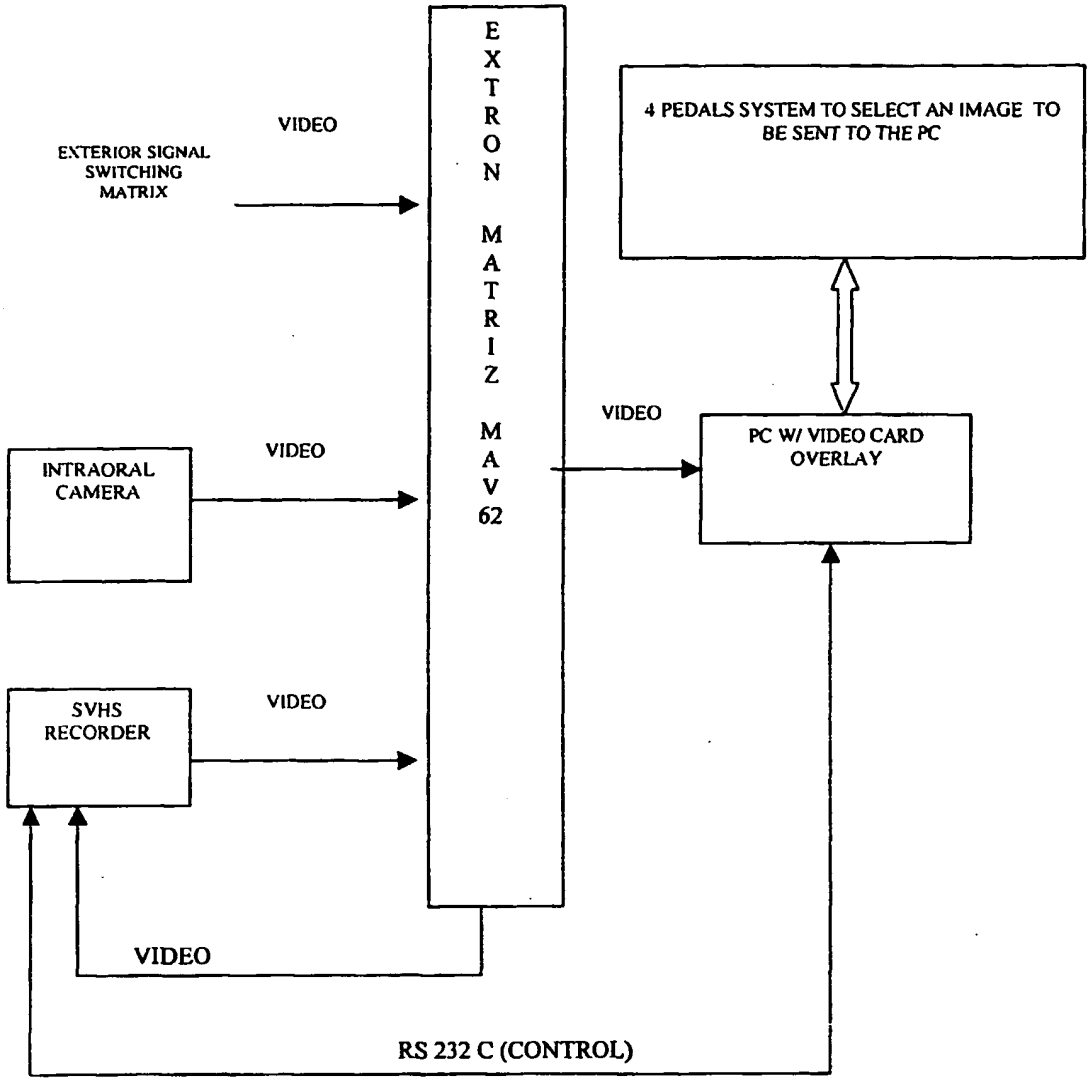
EXTRON MATRIZ MAV 62
4 PEDALS SYSTEM TO SELECT AN IMAGE TO BE SENT TO THE PC
EXTERIOR SIGNAL SWITCHING MATRIX
VIDEO
INTRAORAL CAMERA
VIDEO
SVHS RECORDER
VIDEO
VIDEO
PC W/ VIDEO CARD OVERLAY
VIDEO
RS 232 C (CONTROL)

FIG. 7

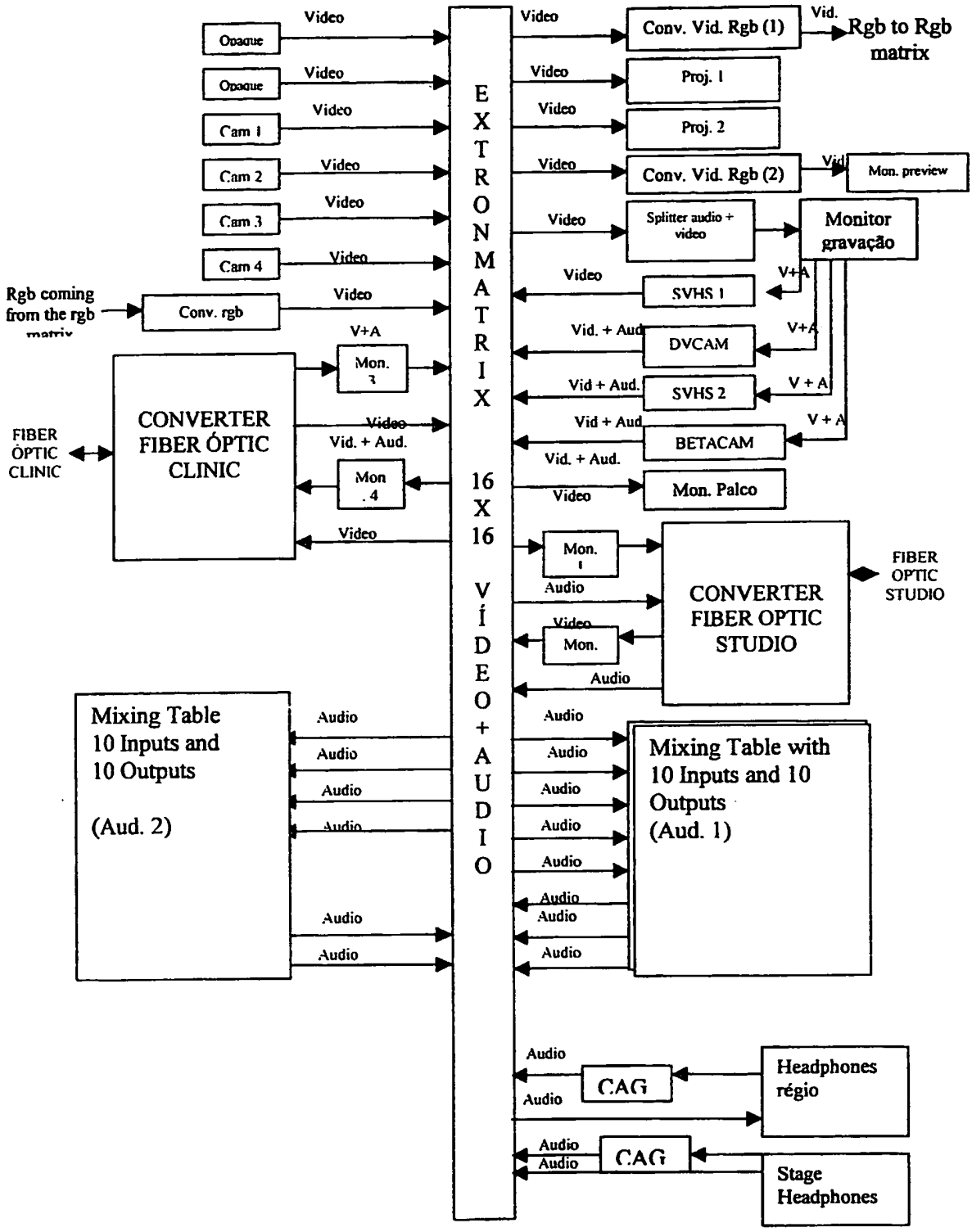
Opaque
Opaque
Cam 1
Cam 2
Cam 3
Cam 4
Video
Rgb coming from the rgb matrix
Conv. rgb
V+A
Mon. 3
CONVERTER FIBER ÓPTIC CLINIC
FIBER ÓPTIC CLINIC
Vid. + Aud.
Mon. 4
EXTRONMATRIX 16 X 16 VÍDEO+AUDIO
Conv. Vid. Rgb (1)
Vid.
Rgb to Rgb matrix
Proj. 1
Proj. 2
Conv. Vid. Rgb (2)
Mon. preview
Splitter audio + video
Monitor gravação
SVHS 1
DVCAM
SVHS 2
BETACAM
V+A
V + A
Vid + Aud.
Mon. Palco
Mon. 1
Mon.
CONVERTER FIBER OPTIC STUDIO
FIBER OPTIC STUDIO
Audio
Mixing Table 10 Inputs and 10 Outputs (Aud. 2)
Mixing Table with 10 Inputs and 10 Outputs (Aud. 1)
CAG
Headphones régio
Stage Headphones

FIG. 8

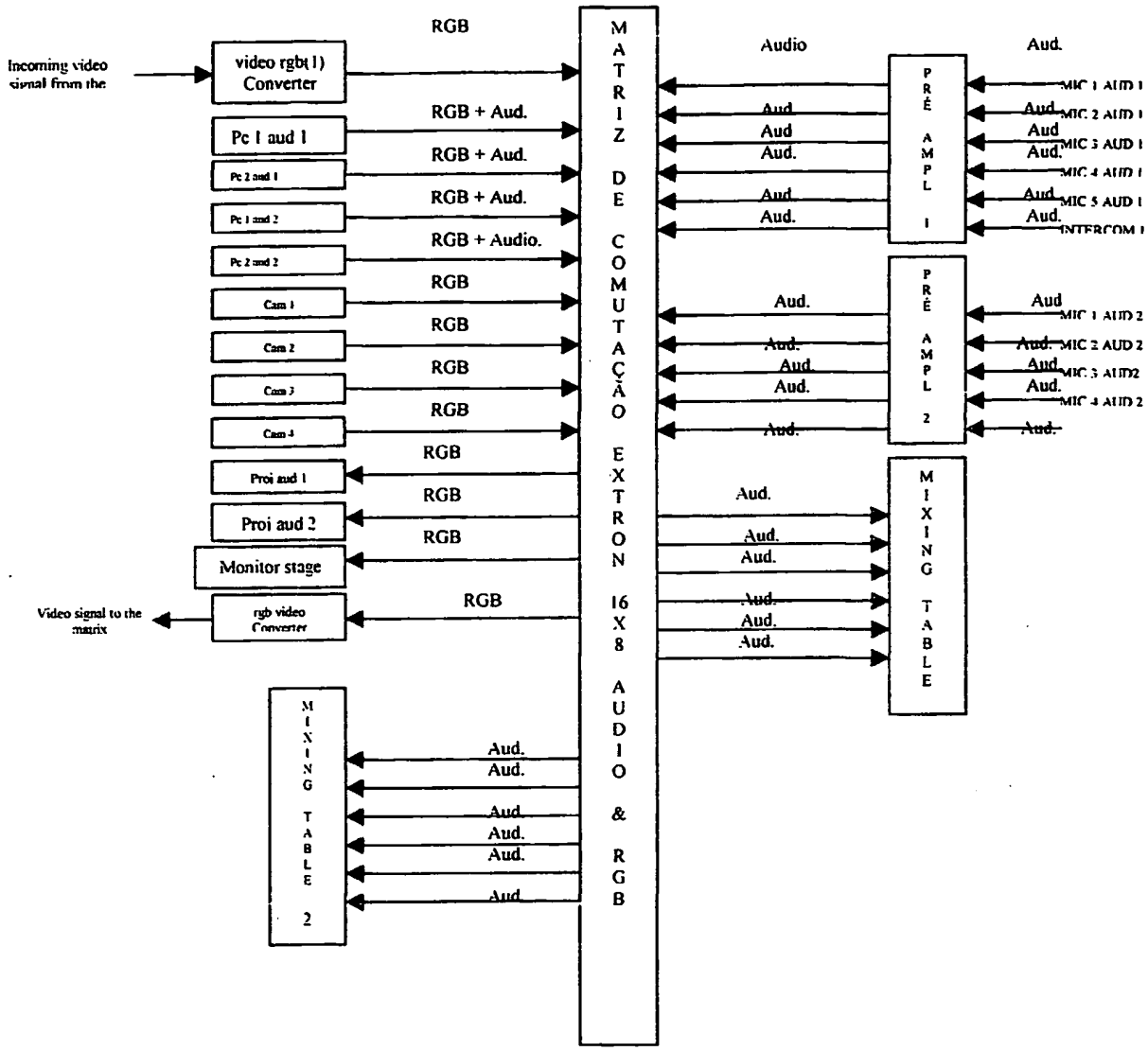
Incoming video signal from the
video rgb(1) Converter
Pc 1 aud 1
Pc 2 aud 1
Pc 1 and 2
Pc 2 and 2
Cam 1
Cam 2
Cam 3
Cam 4
Proi aud 1
Proi aud 2
Monitor stage
rgb video Converter
Video signal to the matrix
RGB
RGB + Aud.
RGB + Aud.
RGB + Aud.
RGB + Audio.
RGB
RGB
RGB
RGB
RGB
RGB
RGB
MATRIZ DE COMUTAÇÃO EXTRON 16 X 8 AUDIO & RGB
Audio
Aud.
PRÉ AMPL 1
PRÉ AMPL 2
MIC 1 AUD 1
MIC 2 AUD 1
MIC 3 AUD 1
MIC 4 AUD 1
MIC 5 AUD 1
INTERCOM 1
MIC 1 AUD 2
MIC 2 AUD 2
MIC 3 AUD2
MIC 4 AUD 2
MIXING TABLE
MIXING TABLE 2

FIG. 9

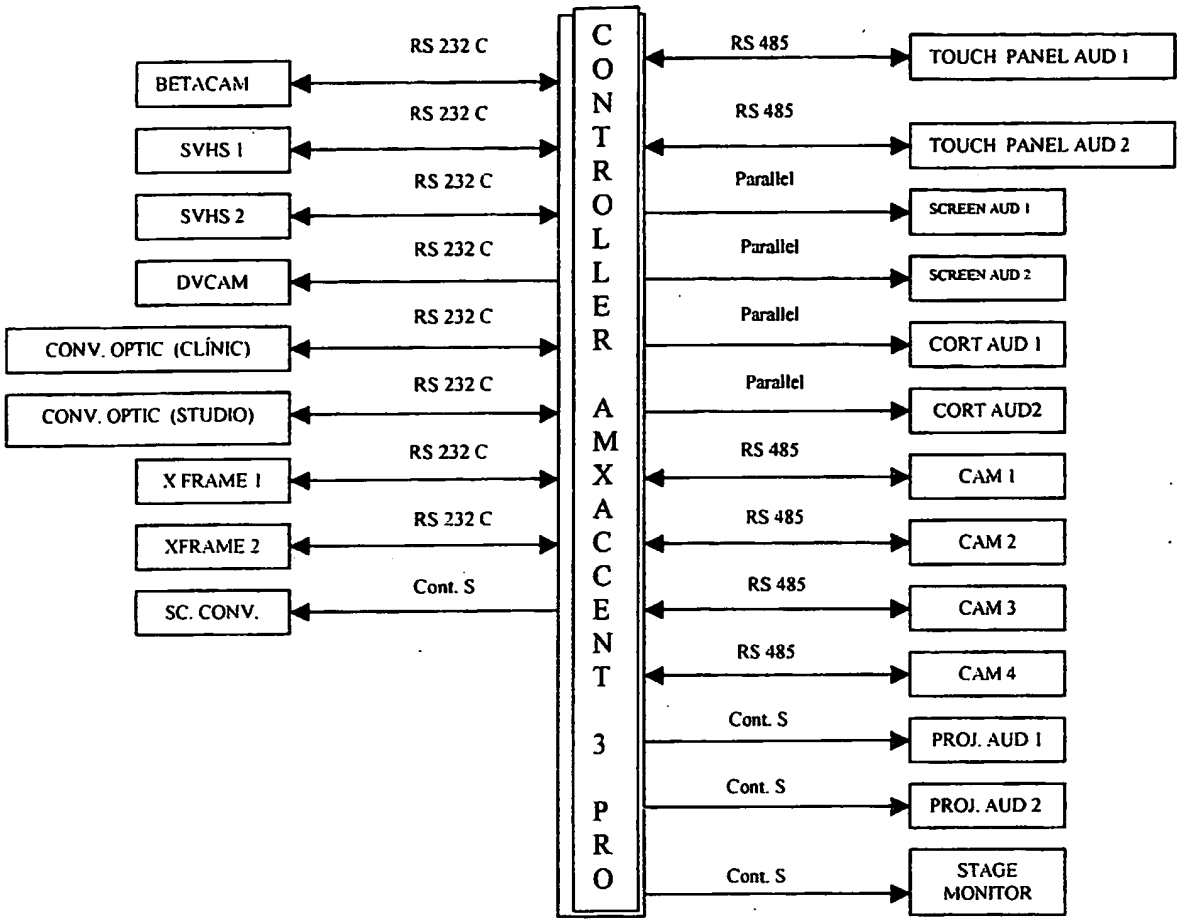
BETACAM
SVHS 1
SVHS 2
DVCAM
CONV. OPTIC (CLÍNIC)
CONV. OPTIC (STUDIO)
X FRAME 1
XFRAME 2
SC. CONV.
RS 232 C
RS 232 C
RS 232 C
RS 232 C
RS 232 C
RS 232 C
RS 232 C
RS 232 C
Cont. S
CONTROLLER AMXACCENT 3 PRO
RS 485
RS 485
Parallel
Parallel
Parallel
Parallel
RS 485
RS 485
RS 485
RS 485
Cont. S
Cont. S
Cont. S
TOUCH PANEL AUD 1
TOUCH PANEL AUD 2
SCREEN AUD 1
SCREEN AUD 2
CORT AUD 1
CORT AUD2
CAM 1
CAM 2
CAM 3
CAM 4
PROJ. AUD 1
PROJ. AUD 2
STAGE MONITOR

FIG. 10

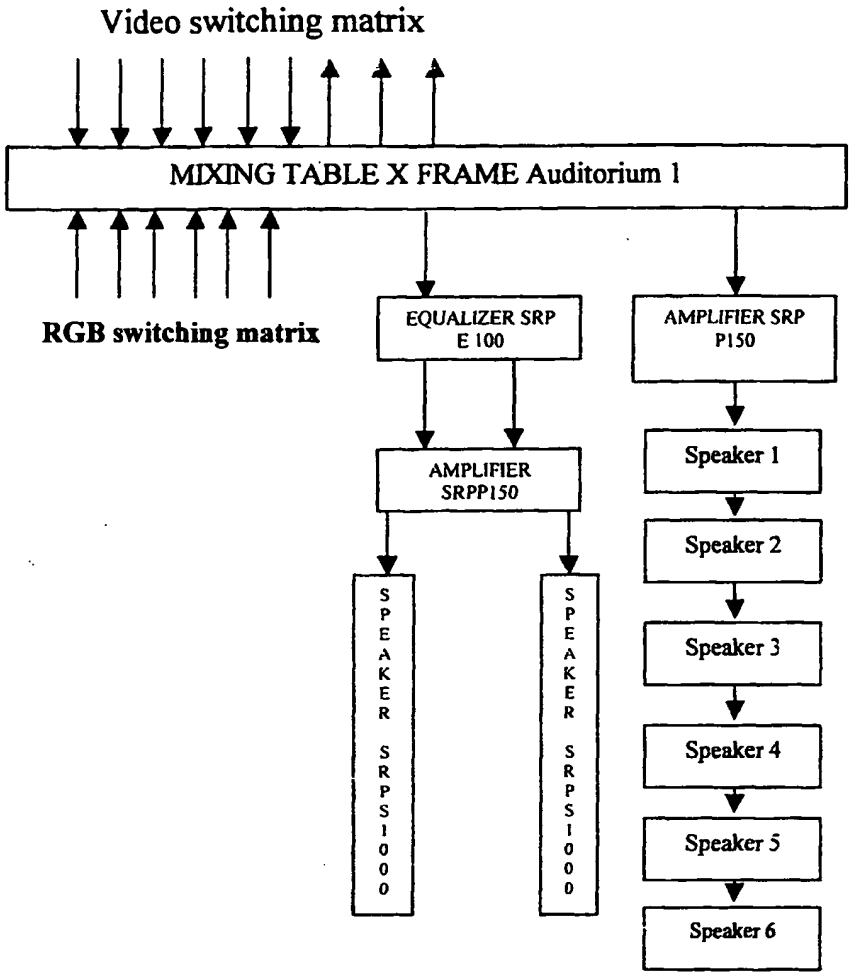
Video switching matrix
MIXING TABLE X FRAME Auditorium 1
RGB switching matrix
EQUALIZER SRP E 100
AMPLIFIER SRP P150
AMPLIFIER SRPP150
SPEAKER SRPS1000
SPEAKER SRPS1000
Speaker 1
Speaker 2
Speaker 3
Speaker 4
Speaker 5
Speaker 6

FIG. 11a

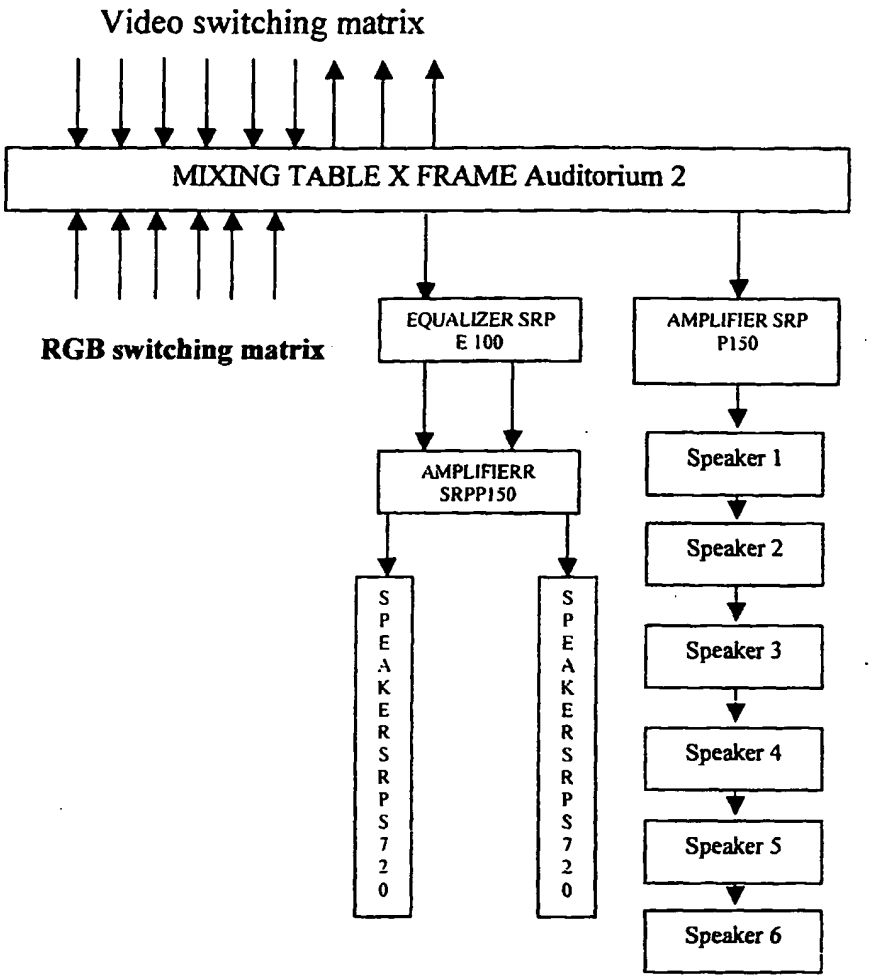
Video switching matrix
MIXING TABLE X FRAME Auditorium 2
RGB switching matrix
EQUALIZER SRP E 100
AMPLIFIER SRP P150
AMPLIFIERR SRPP150
SPEAKERSRPS720
SPEAKERSRPS720
Speaker 1
Speaker 2
Speaker 3
Speaker 4
Speaker 5
Speaker 6

FIG. 11b

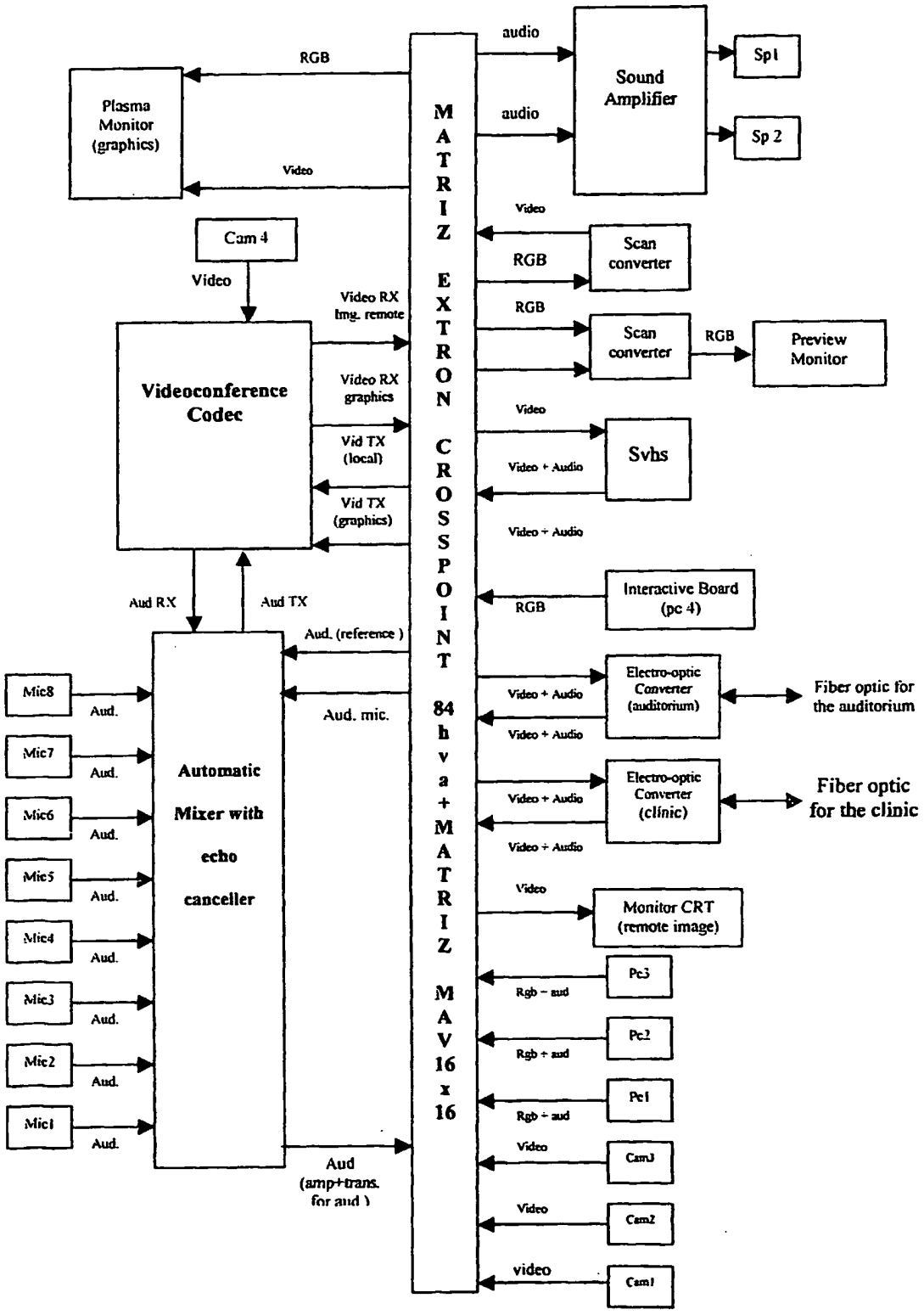
Plasma Monitor (graphics)
RGB
Video
audio
audio
Sound Amplifier
Sp1
Sp 2
MATRIZ EXTRON CROSSPOINT 84 hva + MATRIZ MAV 16 x 16
Cam 4
Video
Video RX img. remote
Video RX graphics
Vid TX (local)
Vid TX (graphics)
Videoconference Codec
Video
RGB
Scan converter
RGB
Scan converter
RGB
Preview Monitor
Video
Video + Audio
Svhs
Video + Audio
RGB
Interactive Board (pc 4)
Aud RX
Aud TX
Aud. (reference)
Aud. mic.
Mic8
Mic7
Mic6
Mic5
Mic4
Mic3
Mic2
Mic1
Aud.
Automatic Mixer with echo canceller
Aud (amp+trans. for aud)
Video + Audio
Video + Audio
Electro-optic Converter (auditorium)
Fiber optic for the auditorium
Video + Audio
Video + Audio
Electro-optic Converter (clínic)
Fiber optic for the clinic
Video + Audio
Video
Monitor CRT (remote image)
Rgb + aud
Pc3
Rgb + aud
Pc2
Rgb + aud
Pc1
Video
Cam3
Video
Cam2
video
Cam1

FIG. 12

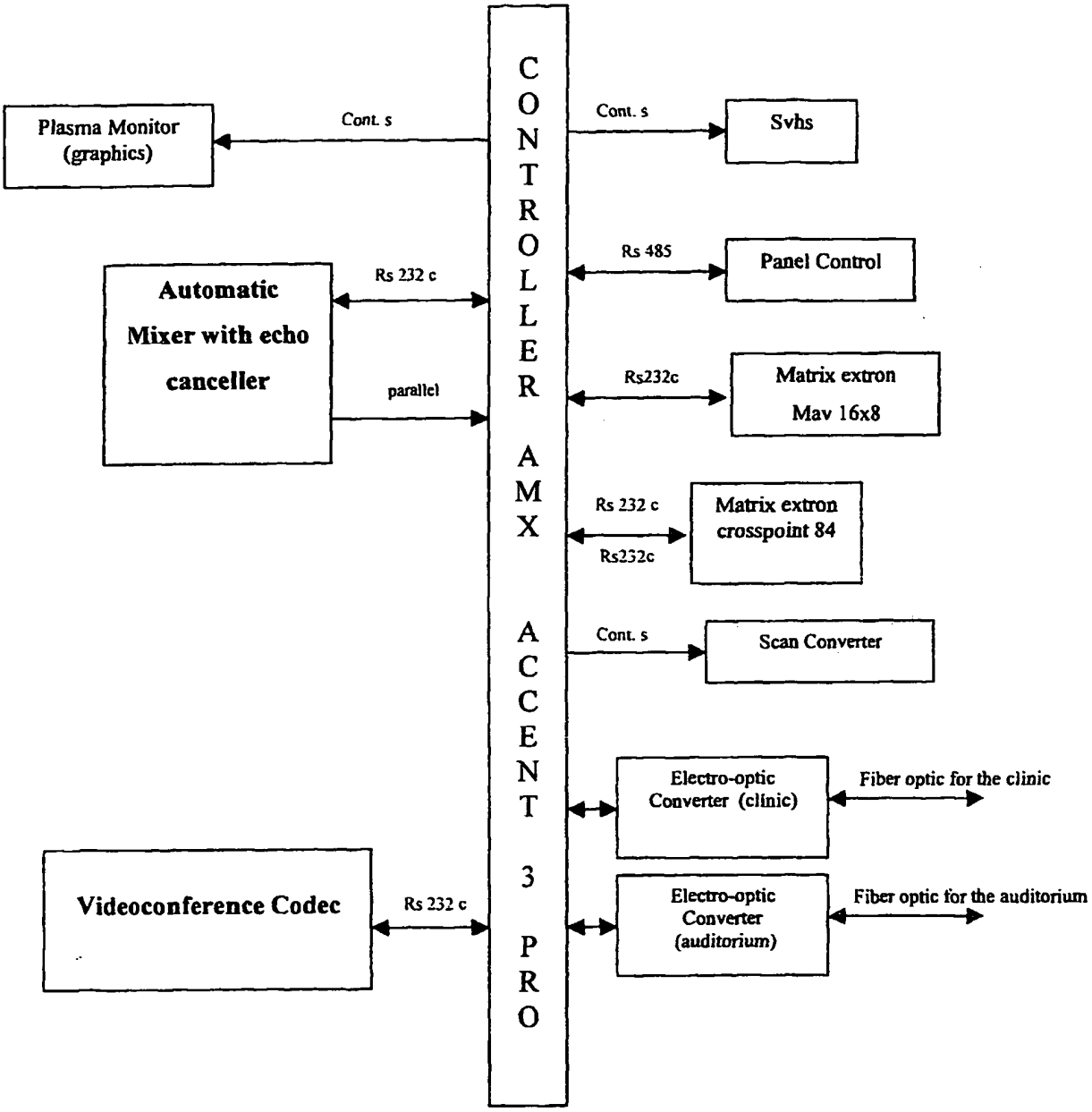
Plasma Monitor (graphics)
Cont. s
Cont. s
Svhs
Automatic Mixer with echo canceller
Rs 232 c
parallel
Rs 485
Panel Control
Rs232c
Matrix extron Mav 16x8
Rs 232 c
Rs232c
Matrix extron crosspoint 84
Cont. s
Scan Converter
Electro-optic Converter (clinic)
Fiber optic for the clinic
Videoconference Codec
Rs 232 c
Electro-optic Converter (auditorium)
Fiber optic for the auditorium
CONTROLLER AMX ACCENT 3 PRO

FIG. 13

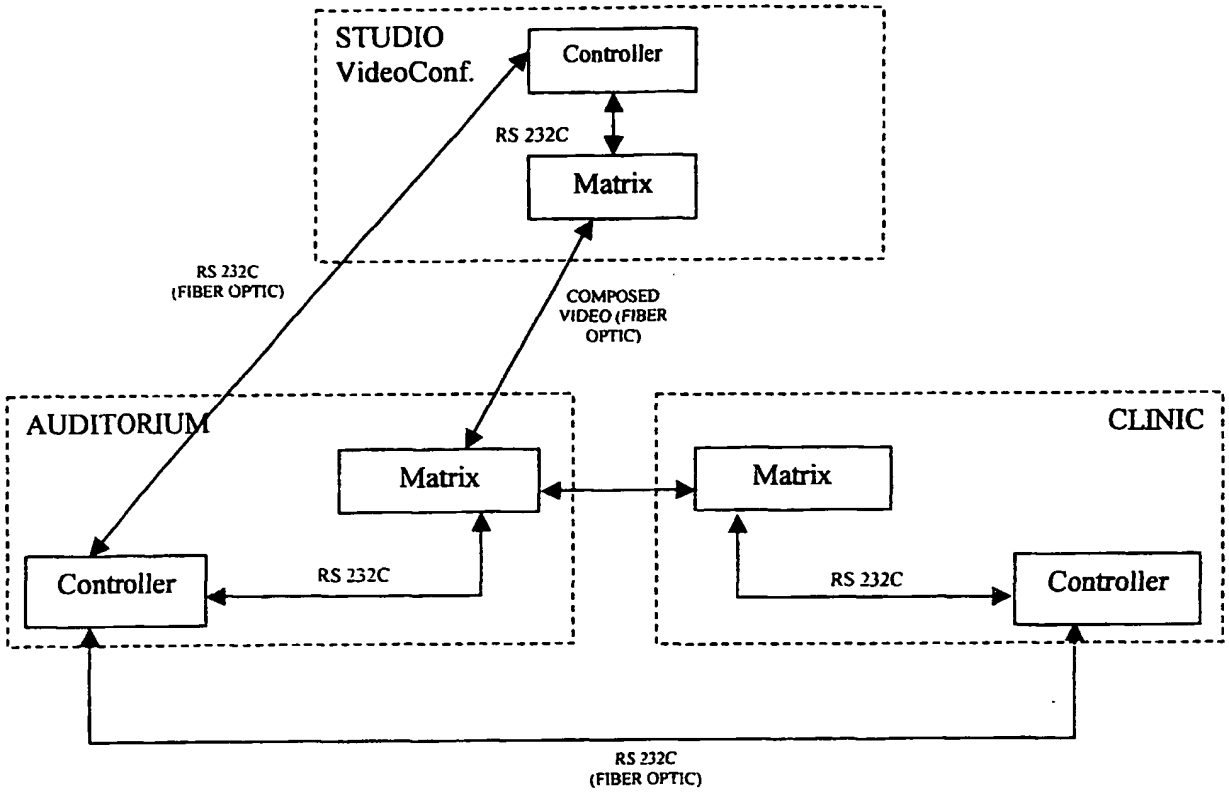
STUDIO
VideoConf.
Controller
RS 232C
Matrix
RS 232C
(FIBER OPTIC)
COMPOSED
VIDEO (FIBER
OPTIC)
AUDITORIUM
CLINIC
Matrix
Matrix
Controller
RS 232C
RS 232C
Controller
RS 232C
(FIBER OPTIC)

FIG. 14

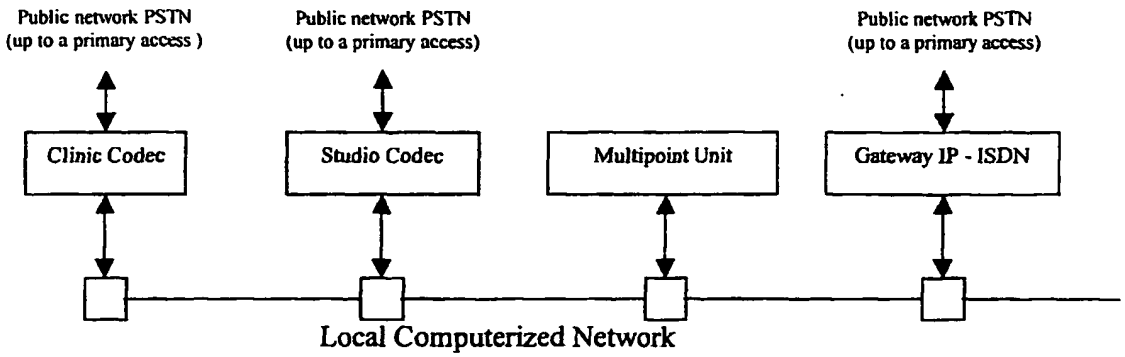
Public network PSTN
(up to a primary access)
Public network PSTN
(up to a primary access)
Public network PSTN
(up to a primary access)
Clinic Codec
Studio Codec
Multipoint Unit
Gateway IP - ISDN
Local Computerized Network

FIG. 15

INTERNATIONAL SEARCH REPORT

International Application No
PCT/PT 02/00018

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G09B7/00 H04N7/15

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G09B H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 288 753 B1 (FANTINI WILLIAM M ET AL) 11 September 2001 (2001-09-11) column 8, line 51-55 column 9, line 3-16 column 9, line 60 -column 10, line 1; figures 1,2	1-52
X	WO 95 28804 A (ACTV INC) 26 October 1995 (1995-10-26) page 3, line 3-18	1-52

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
6 March 2003	25 03 2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	OSKAR PIHLGREN/JA A

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/PT 02/00018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6288753 B1	11-09-2001	NONE	
WO 9528804 A	26-10-1995	US 5537141 A	16-07-1996
		AU 686795 B2	12-02-1998
		AU 2290795 A	10-11-1995
		EP 0755608 A1	29-01-1997
		WO 9528804 A1	26-10-1995
		US 5585858 A	17-12-1996